WILLIAM H. STERNER

THE SCIENCE OF POETICS *and* THE POETICS OF SCIENCE:

Recovering Aristotle's Empirical Science in the Context of Our Loss of Teleological Significances

Conceptual and Historical Studies of Science
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Preface:
Comprehensive Statement of the Exegetical Project as an Overview of the Problematic of the Disruptions of Science and Technology with regard to Teleological Reasoning

This project reports on the specialized exegesis of the conceptual and methodological foundations of Aristotle's *Poetics* as a productive science of both ancient and modern telic significance. The metapragmatic productivity of the *Poetics* that aids poets arises out of Aristotle's use of what I have named '*Arithmoi* of Phenomena' as methods to determine essential understandings of our experience. The central focus in this report is on Aristotle's method of causal "species" or genre differentiation in poetic science as grounded in the different poetic capacities for imitating – in media, of objects, by manners, and all together with purposiveness.

Intrinsic to Aristotle's methods of species differentiation and the definition of Tragedy is the fact that they explicitly include the teleological functions of the catharsis of pity and fear. His overt use of teleological reasoning about artistic imitation as a source of learning and delight that is common to all humans is what makes his *Poetics* useful to poets and aesthetically enlightening to audiences. This background of productive teleology allows a reconstruction of Ernst Mayr's "teleological consummatory acts," despite Mayr's later abandonment of the concept in favor of a reduction of life-form activities to computed behaviors (Mayr 1974, 2004). Aristotle's understanding of the Attic Greek political society and ethical character, as well as universally shared human poetic capacities, enabled him to find the functions of human excellence within the healing and completing purposes of catharsis in the city.

The larger project has the underlying purpose of approaching our contemporary problems *of* and *with* teleology and the relations of those problems to various modes of numeracy involved in the daily activities of human beings. Those diversely varied "everyday" activities from citizen to scientist are constitutive of a recurring plurality of 'common sense habitats' that vary across culturally situated times and locations but share similar covarying numeric skill sets that can be abstractly stated in relation to each other. The wider project attempts this clarificatory goal through a foray into a sequence of combinatoric models with different underlying numeracies that builds an heuristic bridge to modern formal systems, starting with Aristotle's differentiation of a small number of poetic "species" and ending with countably infinite symbol systems.

The sequence of combinatoric models exhibits two very different concepts of "essence" that are both generative of human significances: phenomenal essence in experience *and* mathematical essence in number. It exhibits these differences through an analysis of the problem of a decreasing teleological expressiveness *and* an increasing formal precision in symbolization in the movement from Natural Languages to Formal Symbolic Languages. The sequence tracks how expressions of numeracy (*arithmoi*) move from the greater telic expressiveness of higher-order phenomenal representations in natural languages to the greater mathematical precisions of higher-order formality in artificial languages. Recognizing these two sources of human significance brings us to a statement of the wider cultural problematic as John Dewey formulated it in 1938:

> The subject-matter of science is stated in symbol-constellations that are radically unlike those familiar to common sense; in what, in effect, is *a different language*. … In the region of highest importance to common sense, namely, that of moral, political, economic ideas and beliefs, and the methods of forming and confirming them, science has had even less effect. … These considerations fix the meaning of the statement that the difference that now exists between common sense and science is a social, rather than logical matter. *If the word "language" is used not just formally, but to include its content of substantial meanings, the difference is a difference of languages*. (Dewey 1938, pp. 77-78. Italics mine.)

In the context of this project, Dewey's problematic lies in finding ways to productively reverse this sequence of modes of numeracy into a new kind of bilingualism. Since these two modes are bridged across a range of different, abstractly situated, numeracies captured by the heuristics of pluralistic model-making, such a bridging may provide conceptual grounds for developing the hybrid disciplines of Digital Humanities as co-constitutive with the problematics of Humanizing the Digital in a developing cultural aesthetic of countably infinite precisions. That goal is further concretized by a disclosure of how Aristotle's science makes principled use of a <u>term logic of extended scientific discourse</u> where scientific terms in natural language argument are polyvocal, or multiply significant *within the context of a substantive science*, and have a manifold of implications in the concepts and methods of his foundational development of empirical science by means of "saving the appearances" (Owen 1961, Nussbaum 1986). We have lost track of these integrative powers of rigorous natural language argument (Erickson, Daston, et. al. 2013) in the face of the profound mechanistic advances of experimental and mathematical science made manifest through their technological applications. John Dewey (1938) states a further problematic consequence of these advances:

> In the most important matters *the effect of science upon the content and procedures of common sense has been disintegrative. This disintegrative influence is a social, not a logical, fact.* But it is the chief reason why it seems so easy, so "natural," to make a sharp division between common sense inquiry and its logic and scientific inquiry and its logic. …
>
> *Instead of science eliminating ends and inquiries controlled by teleological considerations, it has on the contrary, enormously freed and expanded activity and thought in telic matters.* … The same sort of thing holds of the qualities with which common sense is inextricably concerned. *Multitudes of new qualities have been brought into existence by the applications of physical* [and other] *science*, and, what is even more important, *our power to bring qualities within actual experience when we so desire, has been intensified almost beyond the possibility of estimate.* (Dewey 1938, 76-77. Italics and square brackets mine.)

Given this wider problematic context, the primary conclusion for the project is that the further telic synthesis of modern sci/tech and common sense habitats depends on developing hybrid combinations of univocal and polyvocal scientific terms in discursive arguments. That is, arguments that include teleological reasoning with its powers to productively and beneficially complete human experiencing within its diverse habitats through positive growth and integration.

The concretely divergent reality of current global experiencing in all its habitats includes the introductions and disruptions of a new kind of common sense habitat with a new kind of numeracy originating in computational technology – the experiencing of computed "nonconscious cognitions" (Hayles 2015, 2016, 2017) and the living of "life on the screen" (Turkle 1997, 2017) now underlying work and play in the daily activities of everyone on the planet with access to the countably infinite scaffolding provided by a smartphone. My claim is that we need teleologically completing syntheses of the two languages into '*Arithmoi* of Hybrid Significances' that combine the respective linguistic powers of expression in order to achieve 'teleological consummatory acts' appropriate to facilitating the integration of scientific and technological advances into the political sustainability and equitable well-being of common sense habitats whether they be under conditions of hostility or of comity.

There is of course an immense literature on the concept of "common sense" starting with Aristotle's *aísthēsis koinȅ* (αἴσθησις κοινὴ), (*De An. iii.* 1) and his reliance on commonplace opinions or *endoxa* (ἔνδοξα), and continuing with a modern dating to the Enlightenment Philosophes and their use of it to help ground democracy as popularly marked by Thomas Paine. Contemporary thinkers include G. E. Moore, Clifford Geertz, Hannah Arendt, the Continental Philosophers of the "lifeworld," and Sophia Rosenfeld's *Common Sense: A Political History.* This is not the place to explore the conceptual semantics of the tradition. Instead I am focusing on building upon Dewey's use of 'common sense inquiry' as presaged by Aristotle's methods of saving appearances, and adapting it to a more biological and formal symbolic framework. It was Aristotle that turned common sense inquiry into science. We are now faced with the problems of reversing that relation by transforming the sciences into the diverse pluralities of common sense. It should be clear that numeracy is a core component of common sense, and that numeracy varies historically and culturally as well as individually.

Interpretive Scene I: *Setting the Scene for Approaching the Text*

Preface to Interpretive Inquiry

How might we obtain insight into how Aristotle conducts scientific knowing, in order to discover what may still be of scientific and cultural value for us today? Moreover, how does his science proceed in a way to help poets with their process of creating imitations? With regard to the *Poetics*, rather than disregarding it as a 'science', how might we view poetics as a 'productive science', in keeping with Aristotle's distinctions between theoretical, practical, and productive sciences? Although given little attention in the scholarly literature 'as science', could the *Poetics* be a kind of human-centered and life-enhancing science?

In order to understand Aristotle's scientific principles and methods, one approach is to lay out precisely Aristotle's doctrines of, say, 'genus', 'species', 'essence', and 'cause'. This approach aims to determine these concepts in a fully theoretical way, reducing the *Poetics* to a theoretical text that does not also speak to poets or critics. For example, if one assumes a commonplace commitment of 20th-century scholarship to a concept of 'essence', then according to this doctrine there is no 'essence' of poetry because (according to Aristotle) poetry "could be otherwise."

Another approach to understanding Aristotle's scientific principles and methods is to lay them out as his text proceeds through them – which is what this project aims to do. At a 'right angle' to the doctrinal approach, this process of interpretation opens up a more intimate account of how Aristotle's discourse actually concretizes a specialized scientific inquiry in a continuous sequence of scientific techniques. For example, his use of the concept of 'species themselves' (*eỉdôn aủtês*) for artistic making unfolds in determinate ways according to his sequential causal accounts.

Aristotle applies his fundamental scientific concepts, such as cause, species, genus, and definition throughout his treatises, including the *Poetics*, although such an inclusion would not accord with our received view of his doctrine. Perhaps his scientific concepts are more flexible than what we tend to grant him when we consider his physical and biological sciences. Some Aristotelian scholars, such as James Lennox (2001) and others[1], are also putting forward such indications of a greater methodological and conceptual flexibility in Aristotle's sciences.

Indeed, Aristotle's science of poetics takes the activities of poets as genuine human phenomena which are more complex than the defined conceptual closures of theoretical science: artistic productions are both intrinsically made with variations and also based in the complexities of the teleological imports of human activities. Like the 'practical sciences' which he asserts are intrinsically dialectic rather than purely theoretical, poetics as a productive science is at root dialectical and yet more technical than the practical sciences (ethics, politics), because of the detailed specifics of artistic practices such as plot construction and use of media. The *Poetics* deals with the higher-level qualities presented by art in a technical way that is nonetheless very good anthropology and psychology of Greek culture, as indicative of an historically situated human nature. Thereby, the *Poetics* is more interesting to us today precisely because Aristotle's science of poetics has a worked-through understanding of how the teleology of catharsis works for poets and audiences. He achieves this understanding by borrowing the concept of 'soul' or

[1] For further examples see: David Balme, "Aristotle's biology was not essentialist," 1987; Pellegrin 1987; Wilkins 2009, ch. 1; Winsor 2003.

‘life-form’ as a scientific analogy for the activity of plot. (I’m characterizing ‘life-form’ as a more appropriate translation for *psyche* in our modern context.)

As we seek to integrate explosive scientific and technological advances into our cultures in fruitful and humanizing ways, what makes Aristotle’s *Poetics* so valuable to us today is that his scientific discourse is a concrete laying out of the variations of phenomena as organized in specialized ways through his scientific concepts and methods. Of course, we have only the text of the Poetics as our basis for insight, rather than also knowing how he first turned to the *empeiría* in practice: his text isn’t so much a factual report of his research in general as we might expect from a scientific article today, but instead proposes first principles that he pulls together into a causal system of ‘species-themselves’ and consequently goes on to define Tragedy grounded in those species phenomena. In fact, Aristotle even goes so far as to identify ‘Plot’ as an explicit primary factor or principle (*arche*) for Tragedy, as well as interpreting ‘Plot’ through a scientific analogy to soul or life-form as a first actuality (*Poet.* 1450a39).

In order to recover the underlying *scientific procedures* driving Aristotle’s account of poetic making, this project intervenes in the text through a process of multiple abductive interpretations in order to test heuristic reconceptualizations of Aristotle’s reasoning against the text to the point of “isomorphic” rigor, where the reconceptualizations concretely articulate his scientific concepts at work. For example, we need to have a reliable conceptualization of the work that Aristotle’s use of the system of the four causes performs to speciate the different modes of imitative making. Much can be recovered from Aristotle’s texts in terms of a process of interpretation, in addition to extracting doctrines.

Exogenous Beginning Points – Why read Aristotle's **Poetics** <u>*as a*</u> *productive science?*

A. To fill a gap in the research into the Poetics, *which has not covered it as a productive science*

Whatever the intrinsic worth of reading the *Poetics* as a science, it might factually be the case that this project has already been well covered by the scholarly community and therefore another treatment is less likely to make a contribution to our knowledge.

It is already well known that Aristotle's *Poetics* has been influential in aesthetics across millennia. There have been several serious and systematic readings of it in the last century or so, including those by Ingram Bywater, R. S. Crane, M. Pabst Battin, Gerald Else, Seth Benardete and Michael Davis, L. Golden and O. B. Hardison, Stephen Halliwell, Richard P. McKeon, Fredrich Solmsen, and Kenneth Telford, among others. Even if not in complete agreement, all of their readings are insightful, and help with the understanding of fine art both for the ancient Greeks, and for aesthetic theory since then. For the most part, with some exception for the Chicago Critics,[2] these readings have taken the text in terms of its subject matter – poetics-itself – and then worked with it in relation to various conceptions of aesthetics in de facto ways that leave the relationship of the *Poetics* to the rest of Aristotle's sciences unmarked.

Even so, the *Poetics* might have been the focus of a specialized interest group in the philosophy of science. Again, that is not the case: our contemporary philosophers of science have not treated the *Poetics* as a source of insight into Aristotelian science. Of course, present-day scholars constantly bring in Aristotle's use of such key scientific terms as 'essence', 'change',

[2] R. S. Crane, R. McKeon, E. Olson, W. Booth, and R. Buchanan, among others. The Chicago Critics took the Poetics as laying out a generalizable method of doing poetics that could be applied to contemporary aesthetics in a systematic, and thereby disciplined and scientific way.

‘potential and actual’, ‘soul’, ‘nature’, ‘substance’, ‘definition’, ‘division’, etc. from the rest of the Aristotelian corpus to help with the interpretation of the *Poetics*. Correspondingly, an ongoing scholarly network of such concepts forms the intertextual world of interpretation for the treatise. To be sure, most of the above-mentioned scholars all give careful and systematic study of the process of species division or differentiation (analysis of imitation, *διαιρέσεις μιμήσεως*) in the *Poetics*. Still, it is simply an historical fact that Aristotle’s productive science of imitative making has been underappreciated as a science in its own right. This lack of attention is itself a reason for attempting to read the *Poetics* as a productive science: Aristotle’s assertion that imitative making is indeed a reasoned capacity of its own peculiar sort is relatively untested in the scholarly literature.

Similarly, there is a massive literature interpreting the *Poetics* as a treatise on aesthetics, in relation to ethics and politics, and in conjunction with the use of terms such as ‘catharsis’ and ‘metaphor’ in many contexts, both historically and in our times. However, almost none of this tradition takes Aristotle at his word when he divides the whole of science up into theoretical, practical, and productive sciences. Certainly, the journal literature in current philosophy of science ignores the scientific character of Aristotle’s productive science.[3]

Overall, I did find a few cases of treating the *Poetics* as a scientific treatise. For example, Bas van Fraassen’s neoteric essay, entitled “The Theory of Tragedy and of Science: Does Nature

[3] A series of searches (05/--/2011) on more than thirty relevant journals accessible through JSTOR, using combined terms such as “philosophy of science,” “Aristotle,” and “poetics,” produced zero articles focused on the *Poetics* as a science, despite hundreds of hits. This result is different from finding some concept from a different science that is relevant to poetics, or finding something in the *Poetics* that has “philosophic” or “scientific” import in general. Most articles (i.e., thousands of them) on the *Poetics* would be able to make these latter sorts of claims.

Have Narrative Structure?" (2000), goes even further than asserting poetics is a science by claiming that the *Poetics* determines narrative properties for science universally today, not just as a productive science.[4] Still van Fraassen does open up the possibility that Aristotle's poetic science might have relevance to our late modern notions of science. Another case is the scholarly treatment of the poetic science that can be found in Poulheria Kyriakou's "Aristotle's Philosophical Poetic" (1993),[5] which takes Aristotle's technical terms in the *Poetics* as having a scientific standing in Aristotle's corpus as a whole and examines them in the wider context of Aristotle's key term: *arché*, *ἀρχή*. Kyriakou's treatment is interesting in a "first-philosophical" or meta-scientific way because it insightfully acknowledges that the scientific terms within the *Poetics* may have trans-scientific significance for Aristotle. Unfortunately, it leaves the scientific precisions of the proper context of the terms within poetic science aside when in fact those nuanced articulations are what establish the possibility for such meta-scientific generalization in the first place. A third case is Brenda Laurel's *Computers as Theatre* (1991, 2013), which directly appropriates an insightful reading of causation, plot structure, and the arc of dramatic development to the problems of designing computer-user interfaces for complete work cycles. An impressive neoteric appropriation of the *Poetics*, Laurel's theory deserves further study for its insights into making things (*poiêsis* for Aristotle) that would help with the understanding of poetics in a more transhistorical sense, once we have a much fuller determination of poetics as a science. Another important supportive case is the Chicago School of Literary Criticism, which embarked upon a program of generalizing Aristotle's scientific methods of poetics to engage

[4] *Aristotle and Contemporary Science*, ed. Demetra Sfendoni-Mentzou, 2000, pp. 31-59.
[5] *Mnemosyne*, Fourth Series, V. 46, Fasc. 3 (Aug., 1993), pp. 344-355.

with later works of art. No doubt there are more cases out there to be found, but for the most part not in the contemporary journals of philosophy of science.

B. The Poetics *is often misplaced in the organization of Aristotelian science*

For many readers of the text, the fact that Aristotle considered poetics to be one of the specialized knowledges is variously ignored, dismissed as inappropriate to the study of fine art, dialectically assimilated into the practical sciences, or reduced to merely being another "universal art" without a determinate subject matter, e.g. poetic as akin to rhetoric. Yet Aristotle himself clearly divides knowledge into the theoretical, practical, and productive sciences (*epistēmē*).[6] According to McKeon's Introduction to *The Basic Works of Aristotle* (1941), Aristotle makes overt use of his "causes to differentiate a subject of discussion which might otherwise elude precise delimitation." This commitment to giving a causal account of the "natural bases" and "relevant material variants" of imitative making is what makes it possible to interpret the *Poetics* as a science even though it is of artificial objects that might be otherwise. McKeon goes on to say:

> As in the case of rhetoric, the subject matter of poetic analysis cannot be isolated simply, as could, say certain species of animals, but whereas the subject matter of rhetoric is determined roughly by considering the kinds of hearers, poetry and its relevant materials are fixed by considering the performances of poets rather than the sensibility of audiences, and the brief literary history sketched in the opening chapters of the *Poetics* serves the function, therefore, of isolating the natural bases and the relevant material

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[6] Cf. *Metaphysics*, *vi*. 1. 1025b1-28; *N. Ethics, vi.* 3-4; *Topics, vi* 145a15.

> In addition, since natural science, like other sciences, is in fact about one class of being, i.e. to that sort of substance, which has the principle of its movement and rest present in itself, evidently it is neither practical nor productive. For <u>in the case of things made the principle is in the maker</u> - it is either reason or art or some faculty, while in the case of things done it is in the doer – viz. will, for that which is done and that which is willed are the same. Therefore, if all thought is either practical or productive or theoretical, physics must be a theoretical science, but it will theorize about such being as admits of being moved, and about substance-as-defined for the most part only as not separable from matter. (*Met. vi.* 1. 1025b19-28. Ross. Underlines mine.)

> variants of poetry. … The sharpness and detail of his discrimination of poetry from other kinds of art and other productive sciences which make use of like materials may be seen in his treatment of similarities and differences observable in each of the parts of tragedy: [for example,] the importance of plot for poetry and the absence of anything equivalent to it in, say, rhetoric; (pp. xxxi-xxxii.)

On the one hand, McKeon's differentiations are very helpful for situating poetics within Aristotle's range of activities of knowing; on the other, because Aristotle's distinctions do not rigidly fix "productive science" within a closed or deductive structure, poetics can interpenetrate both the practical sciences and rhetoric while retaining a coherent scientific account of its own.

One further nuance in the term "science" (*epistēmē*) is that Aristotle sometimes uses *epistēmē* to refer to just those sciences that treat of the invariable, i.e., the "natural" or "theoretical sciences." Yet in *Metaphysics* (*vi.* 1), he takes a broader more inclusive approach towards knowing in general: "… in general every science which is ratiocinative (*epistēmē dianoētikē*) or at all involves reasoning (*dianoías*) deals with causes and principles (*aitías kaì archás*), more or less precise" (1025b6-8. Ross trans.). This nuanced separation of two senses for *epistēmē* allows Aristotle to refer to practical, productive, and natural (epistemic) sciences as specific divisions within the whole of knowledge. All three divisions consist of "reasoned capacities" leading to an appropriate "state" of ability (*hexis*) to act, make, or demonstrate, respectively. At the same time, he can also refer to all of them together as reasoned knowings (*epistēmē dianoētikē*). I will follow Aristotle by making use of both senses of "science" as the occasions arise.

C. To help us recover the importance of an "interpretive shift towards empirical science," a shift that allows the exegesis of the Poetics *<u>as</u> <u>a</u> <u>single</u> <u>specialized</u> science akin to Aristotle's other sciences*

In order to realize the opportunity provided by the fact that Aristotle's productive science of poetics is laid out in an especially straightforward and orderly manner, it becomes necessary to invert the predominant reading of the *Poetics* as an insightful disquisition on an artistic subject matter that is intrinsically engaging and immediately focused on the works of art for a variety of aesthetic, social and cultural reasons. We must somehow shift to a reading of the treatise as an explicitly intellectual science (*epistēmē dianoētikē*) as a *techné* (*N. Ethics vi.* 3 & 4) that <u>follows and completes human nature.</u> This shift will allow a more direct focus on what it means for the *Poetics* to concretely articulate a "reasoned capacity to make" fine art which appeals to "that which might be" humanly universal, given everyone's share in the cognitive power of imitation.

The *Poetics* admits of these two different but inversely related readings precisely because Aristotle developed it as the specialized productive science of poetics-itself with its own commensurately universal substance of imitative art as such. The interesting semantic turning point or crux here is between the focus on "poems" as finished products intended for appreciation and the focus on the scientific determination of the range of co-causal powers that all poets must choose from in the exercise of their specific arts. The former leads directly to the appreciations of audiences and imitative "borrowing" between artists through the experience of particulars, while the latter leads to the knowledge and understanding that come through grasping the causes at work in the poem. The central term here is the "art-of-the-artist": for in one direction the poet understands experience through the practice of her art, while in the other direction the artist becomes a master of her art through a theoretical knowledge of the causes.[7] In this latter sense, Aristotle's treatise lays out a science of making: it presents a functional account

[7] See *Met. i.* 1., where Aristotle both explains the middle ground between the standpoint of the knowledge of causes possessed by the artist in practice versus the theoretical knowledge of causes possessed by the scientist, while he is himself making a similar but higher-order turn from the specialized knowledge of the scientist to the meta-scientific understanding of the first-philosopher.

of a stable, reasoned capacity (*hexis*) to make that poets could come to understand and use in the practice of their *techné*. The science is "of" that art as found and embodied in actual works of art, or the things produced. The exegetical challenge is to interpret the *Poetics* as a full Aristotelian science of a definite sort, viz. as a productive science of imitative making. The further challenge is to do this interpretation with as much conceptual and methodological rigor as possible – while keeping in mind that the subject matter is the "nature and functioning of the *art* of poetry and of its species" (Else, 1957, p. 4-5), as given in poetic works themselves.

It is natural to do this interpretation within the context of the philosophy of science as an appropriate discipline, given that Aristotle created the first system of specialized sciences. Aristotle himself establishes poetics as a science in the first two Greek sentences of the *Poetics* by positing the field of inquiry for poetics-itself to be those made (*poiêsis, ποίησις*) objects produced by imitation (*mimêsis, μιμήσις*). He soon goes further to determine the formal cause of poetics-itself to be poets as "imitators (who) imitate those acting"[8] (2. 1448a1. Benardete/Davis). Certainly, that fact deserves exploration and proper contextualization within Aristotle's tripartite scheme of the sciences. Helpfully, Richard McKeon provides an intermediate conception for poetics-itself that avoids a rigid attempt to dichotomize the world into theoretical science versus merely subjective human phenomena, as we late moderns tend to do:

> The arts, both the fine and the applied, are included with ethics and politics among the practical sciences broadly conceived in contrast to the theoretic sciences, but in a stricter sense the arts are contrasted as "productive" with morals and politics, which are "practical." The arts are, on the one hand, similar to morals and politics in that they treat, not of natural kinds of "things" such as are the subject matter of the natural sciences, but of the skills and habits and of the causes and the consequences of actions and associations. On the other hand, they are like the theoretic sciences in that they have as subject matter not merely such status of men and consequences of their conduct as the associations and virtues treated in politics and ethics, but rather the artificial things

[8] In transliteration: *mimountai hoi mimoumenoi prattontas*.

> produced by the arts which may be assembled, compared, and defined somewhat after the fashion of natural objects. … The similarity of art to physics is to be found in the likeness of their objects, for the objects of art are produced as nature would have produced them, and in the processes of production and the objects produced, art imitates nature. (Aristotle, 1941, McKeon's introduction, p. xxix. See also Olson 1952 pp. 552ff, in Crane, *et al.* 1952)

These distinctions provide a way through Aristotle's organization of knowledge that allows us to take the *Poetics* as a treatise on a productive science of a certain determinate sort with its own proper subject matter and specialized scientific method without reifying or entitizing the range of theoretical, practical, and productive modes of knowing into rigid boundary separations. But these distinctions do not as yet provide a way to fully invert our approach to the text from its tradition of concerns about works of fine art into one in which we can gain a more direct insight into what it is to be <u>a</u> <u>singular</u> <u>specialized</u> science for Aristotle.

Before going further into the demands of this inversion, it is important to notice some additional facts about the mode of knowledge for a productive science of poetics-itself. It would be a mistake to think that any of Aristotle's sciences of appearances consisted solely of appearances presented as perceptual truths. His sciences do not merely or passively collect appearances, put them in a nice orderly arrangement, and then reflect them back to the reader as "knowledge."[9] In our case, poetic science, i.e. productive science, is more than perception, and

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9 As modern philosophers and consumers of science have painfully discovered again over the last century, there are no pure observation or protocol statements as "conditions of knowing simpliciter" taken as "truth conditions for first person knowledge claims." (See * below.) Antipodally, we have also come to realize there is no strictly analytic approach to knowledge of any sort. (See **.)

*Thomas Uebel, "Neurath's protocol statements revisited: sketch of a theory of scientific testimony," *Studies In History and Philosophy of Science Part A*, Volume 40, Issue 1, March 2009, p. 6. "…Neurath gave conditions not for when I know, but for when we may take it that some third person knows. Moreover, the conditions adduced are not the truth conditions of that knowledge claim, but the conditions under which it is reasonable to accepts somebody's knowledge claim."

more than a collection of opinions. It's a reasoned capacity to make something (*logou poiêtikês hexeos*): a state of capacity (*hexis*) to make (*poiêtikês*) things that are variable, that could be otherwise, as distinct from a state of capacity to demonstrate (*hexis apodeiktike*). It is an art (*techné*), (*NE vi*. 3 & 4). The *Poetics* as a productive science raises the art of a poet – who may not be able to give the reason why (even while apprehending causes in practice) – to a theoretical knowledge of the causes of the work of art. Most crucially, interpreting Aristotle's treatment of poetics-itself as a science facilitates disclosing ideas developed according to scientific procedures, such as classification according to natural causes, essential definition, and conceptual synthesis, as appropriate to the substance of the science. It is the doing of all that which introduces reasoning (*logou*) into imitative making so as to properly interpret and "save the appearances" from a collapse into mere perception without an appeal to what is universal, or to a collapse into relativistic oppositions between opinions without any claim to a standard of taste.

Today we know that mathematics and theoretical science are not discontinuous from the production of fine art, and we often find sources of art and beauty directly in the sciences. (As an example, just think of the use of computers throughout all the arts and sciences). My suggestion is that, given further artifacts utilizing such resources, Aristotle's nuanced and non-reductive divisions of knowledge would have been entirely flexible in assimilating these relationships to his productive science of poetics-itself, just as he was already very willing to accept a continuous differentiation between mathematics itself and the useful art of calculation (*logistiké*).

**W. V. O. Quine, "Two Dogmas of Empiricism," *From a Logical Point of View* (Harvard University Press, 1953; second, revised, edition 1961).

With regard to the further demands of inverting the focus on the *Poetics* so as to treat it as a science, I found it necessary to develop ways of reading that will work to reverse the direction of reading. These ways of reading shift from the poet's interest in applying the techniques that Aristotle makes available or the critic's interest in interpreting imitative art, to the purpose of re-conceptualizing and reenacting his account of a scientific research program. This reading will be from the standpoint of a scientist-reader interested in Aristotle's modes of scientific research and their exposition. By bracketing direct aesthetic inspiration as a primary reason for reading, a scientist-reader can look to how Aristotle goes about laying down a productive science of imitative making, and thereby notice the relative straightforwardness of the tasks and the rationally ordered sequence of stages expounding a reasoned capacity to make aesthetic objects as a case study in Aristotelian science.

In the wider project of understanding Aristotle's fundamental concepts, such a mode of reading would more pointedly facilitate understanding Aristotle's fundamental concepts through their discursive affordances. These contributions include elucidating: a) *scientific terms*: for example, cause (*aitía*), principle (*archê*), species-themselves (*eỉdôn ảutês*), capacities/powers (*dunamin*), method/inquiry (*tês ảutês … methodou*), concrete, composite whole (*tó súnolon*), and parts (*moriôn*), etc.; b) ways of disclosing the structures of his *scientific practices* such as: founding a substantive science, the classificatory differentiation of species, and conducting a dialectic of scientific definition; and c) ways of identifying and tracing specific Aristotelian *argumentative strategies* as they are brought to bear at each step of the exposition. My aim is to provide ways of noticing, of indexing characteristics of his arguments that will preserve the flow and development of his discourse; they are intended to stay within the world and conceptual ecosystem of his text.

D. Reading the Poetics *as a productive science provides a case study for offsetting and then complementing some one-sidedness in present-day interpretations of Aristotle's modes of argument and ideas of what constitutes a science*

Another reason why to read the *Poetics* as a science is to provide a straightforward case study for observing some reductive emphases in present-day interpretations of Aristotle's writings. A persistent issue in the careful reading of Aristotle's texts is how best to deal with the extremely powerful modes of continuous argumentation, as he develops them. One recently popular approach has been to make use of modern formal logic as a framework for assessing his concepts and doctrines. This approach has yielded considerable insight and clarity through formal abstractions from Aristotle's arguments. One of the sources of formal logic's greater deductive strength is its ability to properly formulate countably infinite mathematical relationships.[10] Nevertheless, its very powers of logical reduction are also limiting when it comes to the tasks of unraveling Aristotle's densely codified, sequential, and "contextually syntactic"[11] modes of discourse in their full network of meanings and implications. This logical method of interpreting Aristotelian texts sometimes carries with it the generalized presupposition that since modern mathematical or predicate logic is provably stronger than Aristotle's "term logic," it must be better at stating Aristotle's arguments than he was.

[10] Quine gives this "easily recognizable example":

$$\forall x\, [\neg Fxx \,.\, \forall y \forall z\, (Fxy \,.\, Fyz \,.\!\rightarrow Fxz) \,.\, \exists w\, Fxw].$$

If the predicate F is interpreted as a non-reflexive relation such as "less than" (<), and "$\forall y \forall z$ (Fxy . Fyz .→ Fxz)" is interpreted as the transitivity property of integers, then this property only consistently holds for an infinite universe of integers, while it fails in a finite one. This formula basically asserts that if number x is less than y, and number y is less than z, then x is less than z for all possible x, y, and z. (W. V. Quine, *Methods of Logic*. 1982, p. 215.) Aristotle's logic was not capable of formulating such a property as countably infinite.

[11] This notion will be developed later on in the main body of the Overview below, as one aspect of the "connexitivity" (Dewey 1938) of argumentative discourse.

Ian Mueller has an insightful demonstration of this reductive constraint with regard to the limitations of predicate calculus in comparison to the deeper, more dense, argumentative power of natural language discourse. Mueller's demonstration is quite insightful because it shows the limitations of first-order formalisms entirely within the field of proofs *as practiced by people* in our age. His demonstration discloses a core difference between formal language codification and natural language exposition as an intrinsic differentiation of expressiveness between the two. Mueller's example is all the more telling because it does not require encompassing the discursive treatment of highly complex phenomena of social relations or works of art. The example discloses the limitations of translating arguments into first-order formalisms within the context of mathematical proof, while at the same time giving us an exemplar of how one might use the contrasts of the two modes of expression to disclose the more argumentatively effective aspects of natural language. It is precisely through maintaining the rigors of first-order formalisms that one can notice the higher order significances of natural language discourse that exceed the expressiveness of the formalisms.

With his characteristic elegance, Mueller surfaces some underlying problems with expecting Aristotle's scientific discourse to be logical in propositional or even predicate form, faulting Aristotle for not doing so in the first place, and/or reducing his discourse to a sequence of formal sentences. One distorting presupposition here is the belief that Aristotle's term logic is a *formally less powerful* subset of predicate calculus, and therefore formal logic should be able to capture the meanings of all of Aristotle's reasonings better than he could.[12] My claim is that

[12] This is basically the claim (Quine 1982; Łukasiewicz 1957) that Aristotle's logic, while expressive of certain genuine validities, is strictly non-infinitary, and therefore unable to capture certain infinitary facts as *not having* a largest or smallest number, and relations such as transitivity that are expressible in first-order logic.

assuming Aristotle's natural language argumentation can be reduced to first-order formal sentences actually ends up settling for "reductive clarity," while both doing violence to the subtlety of his arguments and very often missing second and higher order significances crucial to later implications. Mueller's example from Hilbert's treatment of geometry argues for the greater expressiveness of natural language discourse.

Mueller begins his demonstration of this reductive constraint by quoting Poincare's formalist interpretation of Hilbert: "Thus Hilbert has … tried to put the axioms [of geometry] in such a form that they could be applied by someone who did <u>not understand their meaning</u> because he had never seen a point, a straight line, or a plane" (Mueller, 1981, pp. 5-6, underlines mine). For the ancient Greeks, even mathematics required some "intuitive" understanding of, say, the Euclidian axioms, and their concept of number (*arithmos aisthetos*, *ἀριθμός αἰσθητός*)[13] was directly tied to experience. Aristotle was certainly committed to the intuitive apprehension of phenomena. Mueller then doubles down on the difficulty with first-order formal reduction with a specific example that he develops in the context of discussing Hilbert's proof of the geometric theorem:

> Given two points *A* and *C* there is always at least one point, *D* on the straight line *AC* which lies between *A* and *C.*

Mueller remarks, "Greek mathematics should not be interpreted in terms of [a modern formalist] structure" (p. 10). To see something of the difference Mueller is pointing to, here is Hilbert's proof as Mueller quotes it:

> According to axiom I,3 there is a point *E* outside the straight line *AC* and according to axiom II,2 there is a point *F* on *AE* such that *E* is a point of the segment *AF*. According to the same axiom and according to axiom II,3 there is a point *G* on *FC*, which does not lie

[13] Aristotle, *Phys.* 219b5-9, *Met. 1092b19,* 1053b28, H. Stein (1990), M. Nussbaum (1979), J. Klein (1968).

on the segment *FC*. According to axiom II,4 the straight line *EG* must then intersect the segment *AC* in a point *D*.

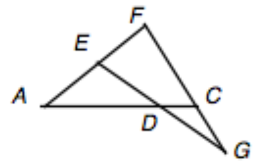

Fig I-1. Diagram for Hilbert's Theorem. SOURCE Mueller 1981, p. 3

Mueller then notes that Hilbert proves the theorem discursively (as given above in five lines) rather than through a logical formalism:

> It would be possible to represent this proof written in English prose as a finite sequence of logical formulas each of which is either an axiom or a syntactic transformation of previous formulas in the sequence in accordance with fixed rules. If the rules were standard ones, such a representation would require more than 100 such formulas and would be virtually <u>unintelligible unless read in the light of Hilbert's proof</u>. (pp. 3-4. Underlines mine.)

Mueller's analysis sheds light on one difficulty of translating Aristotle's arguments into formal logic.[14] Even if we could do this translation in a lossless way, it would most likely be less intelligible than Aristotle's original text.

A second persistent issue with contemporary interpretations of Aristotle is the presupposition that "real" or "true" science provides explanations in an atemporal and strictly nomological-deductive manner, and without any teleological considerations. Robert J. Richards (1992) makes very persuasive and closely related points with regard to the nomological-deductive model of science and the irreducibly historical and discursive characters of scientific explanation. For reframing the interpretation of the *Poetics* as a science, Richards' article entitled "The Structure of Narrative Explanation in History and Biology" lets us take another concrete

[14] Parallel to this observation about discourse, Barwise and Etchemendy's article (1998) presents their discovery that intuitive visual reasoning is sometimes more effective in doing proofs than logical languages even in the situation of *Tarski's World*, a program they constructed for teaching logical formalisms.

step closer to a better formulation by explicitly focusing on the expressive element of "narrative" as it irremediably occurs in scientific discourse:

> Narrative understanding is causal understanding: we explain, and thus understand an event in relation to its causes. But narrative understanding flows beyond the causally efficient [whereas the nomological-deductive understanding does not]. To understand an event, as Aristotle knew, requires one to trace its consequences as well: for a thing is what it becomes. Hence, to understand central events, we must not only regressively track down their efficient causes, but we also must follow out their consequences – what they become. … The narrative traps central events both by its temporally antecedent causes and its temporally consequent effects. The nomological model fails to heed Aristotle's final causes. (Richards 1992, p. 49. Underlines mine.)

What Richards recovers in an exemplary way is the fact that scientific explanation is intrinsically temporal in both its exposition and its historical situatedness, and that nomological-deductive accounts intrinsically reduce out necessary aspects of a temporally and teleologically adequate scientific account, those that "flow beyond" provability alone. The interpretive process to be adopted here will explicitly work to "regressively track down" the effective methodological origins and progressively trace the telic consequences of each moment of Aristotle's arguments that are constitutive of the significances that "flow beyond" provability alone. These re-creative regressions to the elements of Aristotle's arguments and regenerative progressions to their discursively downstream consequences will then be used to ground the interpretations put forward in terms of heuristic reconceptualizations and procedural reenactments.

Even so, Richards' account of narrative explanation in science and Mueller's account of Hilbert's context of discourse are neither an explicit account of Aristotle's science of aesthetic production nor of Aristotle's arguments in the context of discourse, as I believe both would agree. For us, Aristotle assumes and depends upon his readers (ancient or modern) having actually experienced works of fine art as precisely the social and experienceable *phenomena to be saved*. As readers, our concern with Aristotle's discursive arguments is to heuristically re-conceptualize their meanings as best as we can and then methodically reenact them as they unfold in his scientific discourse. In light of the above, we should give Aristotle the benefit of the doubt that his natural language discourse might also be written in a highly condensed and powerfully argued manner[15], and mostly likely not easily, or even possibly, rendered into a logical formalism in ways adequate to a fully narrative scientific understanding.

An architectonic goal of this monograph will be to demonstrate in Scene IV that the first two Greek sentences of Aristotle's *Poetics* as natural language argument are both necessary and sufficient to ground the entire productive science of poetics with its teleological coherence adequate to produce fully cathartic tragedies.

As will be shown to be a simple fact of the matter, Aristotle's "term logic" retains access to polysemy[16], sub-propositional term relationships[17], and higher-order conceptual relations[18] in

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[15] This density and power are intrinsic potentials for natural language discourse. Only the deepest thinkers fully realize these potentials in original ways.

[16] One objective of this project will be to explore the possibility of Aristotle's using polysemy as integral to poetic science itself. Such scientific use would be more than an implicit pluralistic rhetorical effect across readers working in different disciplinary frameworks with different substantive interests (Ceccarelli 1995, 1998), valuable as those rhetorical effects can be for scientific community. For example, in the exegesis I show that Aristotle uses the technical term '*tó súnolon*' or 'concrete, composite whole' in an argumentative sequence of different interpretations for a range of poetic objects as he develops the science, i.e. the essentially "nested" sequence of formal structures of phenomena that develop with an increasing phenomenal specificity: first as 'poetics-itself', then as 'species-itself', third as the particular 'scientifically defined species of tragedy', and fourth as the primary and dominant part of tragic synthesis: 'Plot'. Aristotle treats each of these objects of inquiry as a distinct artifactual whole with its peculiar, differentially distinct, composing functional parts. Another example of an essentially nested sequence of scientific objects is found in Aristotle's *De Anima*. He develops that biological science of soul (*psukhē*) or life-forms in the sequence of nutritive/reproductive soul, perceptive soul, and thinking soul. This sequence is often glossed as different "kinds" of soul, but that obscures their essential development in which the functions of earlier souls are carried forward and their conceptual structures are *transformed* in later ones. Thus, both perceptive and thinking souls also have the powers of nutritive/reproductive soul, but nutrition and reproduction have different structures in each, and so on.

[17] Scientific terms can be in "contrary" (*ènantíon*) relation without being in "contradiction" (*ántiphasis*) (*Met. x.* 3.20-28, 4. 1055a33-b16.)

[18] Provisionally, I take this to mean arguments that lay out or involve "orderings of orderings" of phenomena as might be attributed to the whole of poetic science, i.e. its genus, as one ordering compared to the ordering of the differentiable species of that science, or between the ordering of a single species as a whole and that of its system of functional parts.

a multiply ordered or layered manner that is not readily captured by our formal languages despite their formally greater infinitary mathematical powers. These capacities of "term logic" make Aristotle's scientific discourse especially interesting in the context of the "ancients versus moderns" battle. My proposed interpretive method of reenacting argument development simultaneously along multiple scales of argument dialogically attempts to recover more of Aristotle's subtlety than a single focus on logical analysis typically allows. The proposed interpretive method does this through a wider process of systematically conversing with the text in its multiplicity of implications, in effect recovering the scientific use of polyvocality in extended argument. By '*polyvocality*', I mean speaking for the "many" through the "unified voice" of "one coherent argument in extended discourse" whether that "many" be a manifold plurality of phenomena, the underlying consensus of a community, or the codification of emergent cultural change into fresh aims and purposes that facilitate the ecologically balanced flourishing of human life as situated in the organic whole of life-forms, or all of these together in multiple concordant discourses. Preserving both the subject-matter phenomena of poetic science and the argumentative phenomena of Aristotle's humane and humanizing scientific discourse under the dialogic activity of interpretation will require an exceptionally careful process of re-conceptualizing the scientific ideas and strategies of his arguments through successive heuristic approximations and then following out their purposeful scientific consequences. Aristotle's explicit scientific discipline of "saving the phenomena"[19] as available to finite human activities[20] may prove of great value for our understanding of ourselves and our projected purposes through a "philosophy for limited beings" (Wimsatt 2007). Now that we have achieved a vast scientific mass of knowledge grounded in the specialized pursuit of univocal facts and terms of high precision and specificity, yet painfully lacking a greater integration of those knowledges and their unintended consequences into a *common sense*[21] that is graspable in some way across all the ranges of human activity and daily existence, we need to engage in extended discourse and other modes of communication responsive to the as yet implicit cultural orderings and unexpressed teleological resolutions made possible by this massive achievement.[22] We need to aim at scaffolding the "fragility of goodness" (Nussbaum 1986) not only for ourselves but also for our surrounding and our inhabiting life-form environments.

To initiate this inversion in our perspective on the *Poetics*, from traditional concerns about works of fine art to what it is to be a singular specialized science, and as a ground for

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[19] *N. Ethics vii*, 1. According to Aristotle's general scientific methodology of "saving the phenomena, *Tithenai Ta Phainomena,*" as stated in his practical science of ethics:

> We must, as in all other cases, set the observed facts before us and, after first discussing the difficulties, go on to prove, if possible, the truth of all the common opinions about these affections of the mind, or failing this, of the greater number and the most authoritative; for if we both refute the objections and leave the common opinions undisturbed, we shall have proved the case sufficiently. (Ross, 1145b1-7.)

See my extended discussion of Aristotle's method at various places where Owen's and Nussbaum's groundworks for understanding Aristotle's "saving" are carried forward from the point of view of argument as a process.

[20] See *Physics iii,*6 & 8*.,* and Jonathan Lear on Aristotle's denial of an "actual infinite" (1979-1980 and 1988).

[21] See the long Dewey quote on "common sense" in the subsection on the *Statement of Our Culturally Problematic Situation as a Contrast between Modern and Aristotelian Scientific Terms*.

[22] See long Dewey quote in subsection on the *Statement of Our Culturally Problematic Situation as a Contrast between Modern and Aristotelian Scientific Terms*.

heuristic reconceptualization and procedural reenactment, what follows next is the Bywater translation of the first six chapters of Aristotle's *Poetics*, with my methodological parsings.

A Methodological Parsing of The Poetics *(1-6):*

Aristotle on the Art of Poetry

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http://www.authorama.com/the-poetics-2.html
Aristotle (384 BCE-322 BCE)

Aristotle on the Art of Poetry

(Translation by Ingram Bywater)
Chapters 1- 6, with added methodological parsing into Argument Stages and Technical Milestones on Problem Resolution.
W. Sterner.

Chapter 1

<u>Stage 1</u>[23] – Scientific Foundations - Six starting points for the whole of Aristotle's productive science of Poetics: Theory *and* Method, Imitative Phenomena *and* the Poet's Imitative Capacities as Causal, Plot *and* Poetic Artifact

First Greek Sentence – Poetic Theory and Method, (with the introduction of 'Plot' (*muthos*) as the Central Substantive Term for Expounding the Whole of Poetic Science)

> [1447a10-1447a13] I. Our subject being Poetry, I propose to speak not only of the art in general but also of its species (*eἶdôn aὐtês*) and their respective capacities *(dunamin)*; of the structure of plot (*muthos*) required for a good poem; of the number and nature of the constituent parts of a poem; and likewise of any other matters in the same line of inquiry (*méthodos*). Let us follow the natural order and begin with the primary facts.

Second Greek Sentence – Poetic Phenomena as substantive and Poet's Imitative Capacities as Causal, (with the introduction of the Central Embodiment Term for Poetic Works: 'Concrete, Composite Whole' (*tò súnolon*) which has the Scope of the Entire Science of Poetics-Itself)

> [1447a14-1447a18] Epic poetry and Tragedy, as also Comedy, [and, *kai*] Dithyrambic poetry, and most flute-playing and lyre-playing, are all, viewed as a whole (*tò súnolon*), modes of imitation. But at the same time they differ from one another in three ways, either by a difference of kind in their means, or by differences in the objects, or in

[23] I've added these stage markers and technical milestones to the Bywater text with occasional Greek terms restored. Otherwise the original text is unchanged.

the manner of their imitations.

Stage 2 – Differentiation of Poetic Species according to the poet's capacities for imitating "in which," "of which," and "in what way" as the primary cause of *poíêsis* by acting through material, formal, and efficient modes of causality in imitative making.

Species Differentiation according to Comparisons and Contrasts of Poetic Capacities as Material Causes – "in which." Problem: which uses of media in which species are the most powerfully imitative?

> [1447a19-1447b29] Just as colour and form are used as means by some, who (whether by art or constant practice) imitate and portray many things by their aid, and the voice is used by others; so also in the above-mentioned group of arts, the means with them as a whole are rhythm, language, and harmony—used, however, either singly or in certain combinations. A combination of rhythm and harmony alone is the means in flute-playing and lyre-playing, and any other arts there may be of the same description, e.g. imitative piping. Rhythm alone, without harmony, is the means in the dancer's imitations; for even he, by the rhythms of his attitudes, may represent men's characters, as well as what they do and suffer. There is further an art which imitates by language alone, without harmony, in prose or in verse, and if in verse, [b1] either in some one or in a plurality of metres. This form of imitation is to this day without a name. We have no common name for a mime of Sophron or Xenarchus and a Socratic Conversation; and we should still be without one even if the imitation in the two instances were in trimeters or elegiacs or some other kind of verse—though it is the way with people to tack on 'poet' to the name of a metre, and talk of elegiac-poets and epic-poets, thinking that they call them poets not by reason of the imitative nature of their work, but indiscriminately by reason of the metre they write in. Even if a theory of medicine or physical philosophy be put forth in a metrical form, it is usual to describe the writer in this way; Homer and Empedocles, however, have really nothing in common apart from their metre; so that, if the one is to be called a poet, the other should be termed a physicist rather than a poet. [b20] We should be in the same position also, if the imitation in these instances were in all the metres, like the *Centaur* (a rhapsody in a medley of all metres) of Chaeremon; and Chaeremon one has to recognize as a poet. So much, then, as to these arts. There are, lastly, certain other arts, which combine all the means enumerated, rhythm, melody, and verse, e.g. Dithyrambic and Nomic poetry, Tragedy and Comedy; with this difference, however, that the three kinds of means are in some of them all employed together, and in others brought in separately, one after the other. These elements of difference in the above arts I term the means of their imitation.

Chapter 2

Species Differentiation according to Comparisons and Contrasts of Poetic Capacities as Formal Causes – "of which." Problem: which actions of agents as imitated by poets in which species are the most excellent and worthy of imitation?

> [1448a1-1448a18] II. The objects the imitator represents are actions, with agents

who are necessarily either good men or bad—the diversities of human character being nearly always derivative from this primary distinction, since the line between virtue and vice is one dividing the whole of mankind. It follows, therefore, that the agents represented must be either above our own level of goodness, or beneath it, or just such as we are in the same way as, with the painters, the personages of Polygnotus are better than we are, those of Pauson worse, and those of Dionysius just like ourselves. It is clear that each of the above-mentioned arts will admit of these differences, and that it will become a separate art by representing objects with this point of difference. Even in dancing, flute-playing, and lyre-playing such diversities are possible; and they are also possible in the nameless art that uses language, prose or verse without harmony, as its means; Homer's personages, for instance, are better than we are; Cleophon's are on our own level; and those of Hegemon of Thasos, the first writer of parodies, and Nicochares, the author of the *Diliad*, are beneath it. The same is true of the Dithyramb and the Nome: the personages may be presented in them with the difference exemplified in the ... of ... and Argas, and in the Cyclopses of Timotheus and Philoxenus. This difference it is that distinguishes Tragedy and Comedy also; the one would make its personages worse, and the other better, than the men of the present day.

Chapter 3

Species Differentiation according to Comparisons and Contrasts of Poetic Capacities as Efficient Causes – "in what way." Problem: which styles or modes of imitation used by poets are the most effective and life-like in their imitations?

[1448a19-1448a23] III. A third difference in these arts is in the manner in which each kind of object is represented. [b20] Given both the same means and the same kind of object for imitation, one may either (1) speak at one moment in narrative and at another in an assumed character, as Homer does; or (2) one may remain the same throughout, without any such change; or (3) the imitators may represent the whole story dramatically, as though they were actually doing the things described.

[1448a24-1448a25] As we said at the beginning, therefore, the differences in the imitation of these arts come under three heads, their means, their objects, and their manner.

Historical Trace of Key Emergent Names for Poetic Phenomena – Problem: The natural development of poetic species in multiple cities is insufficient to capture the true natures of the species in their common names. (Poetic science is required to properly complete their species formulations.)

[1448a26-1448b1] So that as an imitator Sophocles will be on one side akin to Homer, both portraying good men; and on another to Aristophanes, since both present their personages as acting and doing. This in fact, according to some, is the reason for plays being termed dramas, because in a play the personages act the story. Hence too both Tragedy and Comedy are claimed by the Dorians as their discoveries; Comedy by the Megarians—by those in Greece as having arisen when Megara became a democracy, and

> by the Sicilian Megarians on the ground that the poet Epicharmus was of their country, and a good deal earlier than Chionides and Magnes; even Tragedy also is claimed by certain of the Peloponnesian Dorians. In support of this claim they point to the words 'comedy' and 'drama'. Their word for the outlying hamlets, they say, is comae, whereas Athenians call them demes—thus assuming that comedians got the name not from their *comoe* or revels, but from their strolling from hamlet to hamlet, lack of appreciation keeping them out of the city. Their word also for 'to act', they say, is *dran*, whereas Athenians use *prattein*.
>
> [1448b2-1448b4] So much, then, as to the number and nature of the points of difference in the imitation of these arts.

Chapter 4

Stage 3 – Teleological completion of species differentiation – "for the sake of which." Problems: which are the best and most imitative species? How did they actually arise?

Species Differentiation according to Humanly Universal Principles and Particular Historical Traces of the emergent poetic functions in the three most excellent species as developmentally improvised by poets and their practices (chs. 4 & 5 combined)

First Telic Abduction: explicitly purposive causation through the exercise of universal human powers – i.e., imitation for Learning and Delight, and rhythm as Natural to humans. Problem: what is common to poets as exercising their artistic capacities *and* audiences experiencing imitative art as human beings for a poetics centered on actual works of art as performances and artifacts?

> [1448b5-1448b23] IV. It is clear that the general origin of poetry was due to two causes, each of them part of human nature. Imitation is natural to man from childhood, one of his advantages over the lower animals being this, that he is the most imitative creature in the world, and learns at first by imitation. And it is also natural for all to delight in works of imitation. The truth of this second point is shown by experience: though the objects themselves may be painful to see, we delight to view the most realistic representations of them in art, the forms for example of the lowest animals and of dead bodies. The explanation is to be found in a further fact: to be learning something is the greatest of pleasures not only to the philosopher but also to the rest of mankind, however small their capacity for it; the reason of the delight in seeing the picture is that one is at the same time learning—gathering the meaning of things, e.g. that the man there is so-and-so; for if one has not seen the thing before, one's pleasure will not be in the picture as an imitation of it, but will be due to the execution or colouring or some similar cause. Imitation, then, being natural to us—as also the sense of harmony and rhythm, the metres being obviously species of rhythms—it was through their original aptitude, and by a series of improvements for the most part gradual on their first efforts, that they created poetry out of their improvisations.

Second Telic Abduction: the **reflexive functions** of the different characters of poets – their own dispositions towards noble or base actions at work in their own artistic choices and practices when making particular works of art; the <u>increasing fitness</u> of meters in speech as commonly used outside of poetry; and the <u>growing excellence</u> of reenacting over telling about for engaging audiences. These three cultural conditions on the development of poetry interact as different second-order cultural developments that frame the poet's three capacities as exercised within their own culture. Problem: how did the different species get their beginnings in Greek culture?

> [1448b24-1449a6] Poetry, however, soon broke up into two kinds according to the differences of character in the individual poets; for the graver among them would represent noble actions, and those of noble personages; and the meaner sort the actions of the ignoble. The latter class produced invectives at first, just as others did hymns and panegyrics. We know of no such poem by any of the pre-Homeric poets, though there were probably many such writers among them; instances, however, may be found from Homer downwards, e.g. his *Margites*, and the similar poems of others. In this poetry of invective its natural fitness brought an iambic metre into use; hence our present term 'iambic', because it was the metre of their 'iambs' or invectives against one another. The result was that the old poets became some of them writers of heroic and others of iambic verse. Homer's position, however, is peculiar: just as he was in the serious style the poet of poets, standing alone not only through the literary excellence, but also through the dramatic character of his imitations, so too he was the first to outline for us the general forms of Comedy by producing not a dramatic invective, but a dramatic picture of the Ridiculous; his *Margites* in fact stands in the same relation to our comedies as the *Iliad* and *Odyssey* to our tragedies. As soon, however, as Tragedy and Comedy appeared in the field, those naturally drawn to the one line of poetry became writers of comedies instead of iambs, and those naturally drawn to the other, writers of tragedies instead of epics, because these new modes of art were grander and of more esteem than the old.

Differentiation of Empirical Sciences Required for doing Poetics as a Specialized Science of Poems: Aristotle performs this differentiation by Establishing the Higher-Order Telic Objectives of Poetic Science as <u>Performatively</u> and <u>Productively aimed at the humanly universal</u> (9. 1451a36-b11), rather than strictly theoretical or factually historical. Aristotle signals this by a turning away from seeking a purely theoretical solution to the problems of poetics and towards the historical and artifactual particularities of poetic phenomena for the sake of better scaffolding the poet's arts in two senses: The sense that the phenomena of imitation cannot be strictly reduced to a theoretical science such as geometry because of the individual, social and cultural particulars of the required <u>productivity</u> (*poíêsis*) of the poet's own engagement; and second, because of the necessary concrete character of poetic artifacts as serving two ends: that of the <u>performatives</u> "by which" the poet as agent imitates (*mimêsis*) out of herself into her culture, *and* the evaluative ordering "at which" the poet aims so as to present events productive of Learning and Delight with consummatory pleasures for the sake of the audience that lives in that culture. Problem: How to advance the inquiry after reaching the endpoint of what the theoretical inquiry alone can determine (i.e., as generated explicitly according to "first things" as poetic capacities with causal efficacy per se)?

> [1449a7-1449a9] If it be asked whether Tragedy is now all that it need be in its

formative elements, to consider that, and decide it theoretically and in relation to the theatres, is a matter for another inquiry.

Third Telic Abduction: separate disciplinary histories of the rise of the three best poetic species as stories of actual phenomenal emergence as it developed into their current state of excellence among the original six species of sentence 2. Problem: what were the important advances in tragic presentations that make them more imitative and thereby more humanly universal?

Historical Trace of Practices and Emergent Final Causes for Tragedy

[1449a10-1449a30] It certainly began in improvisations—as did also Comedy; the one originating with the authors of the Dithyramb, the other with those of the phallic songs, which still survive as institutions in many of our cities. And its advance after that was little by little, through their improving on whatever they had before them at each stage. It was in fact only after a long series of changes that the movement of Tragedy stopped on its attaining to its natural form. (1) The number of actors was first increased to two by Aeschylus, who curtailed the business of the Chorus, and made the dialogue, or spoken portion, take the leading part in the play. (2) A third actor and scenery were due to Sophocles. (3) Tragedy acquired also its magnitude. Discarding short stories and a ludicrous diction, through its passing out of its satyric stage, it assumed, though only at a late point in its progress, a tone of dignity; and its metre changed then from trochaic to iambic. The reason for their original use of the trochaic tetrameter was that their poetry was satyric and more connected with dancing than it now is. As soon, however, as a spoken part came in, nature herself found the appropriate metre. The iambic, we know, is the most speakable of metres, as is shown by the fact that we very often fall into it in conversation, whereas we rarely talk hexameters, and only when we depart from the speaking tone of voice. (4) Another change was a plurality of episodes or acts. As for the remaining matters, the superadded embellishments and the account of their introduction, these must be taken as said, as it would probably be a long piece of work to go through the details.

Chapter 5

Problems: what were the important advances in comedic presentations, given a limiting condition due to the less serious character of comedy?

Historical Trace of Practices and Emergent Final Causes for Comedy

[1449a31-1449a37] As for Comedy, it is (as has been observed) an imitation of men worse than the average; worse, however, not as regards any and every sort of fault, but only as regards one particular kind, the Ridiculous, which is a species of the Ugly. The Ridiculous may be defined as a mistake or deformity not productive of pain or harm to others; the mask, for instance, that excites laughter, is something ugly and distorted without causing pain.

[1449a38-1449b8] Though the successive changes in Tragedy and their authors are not unknown, we cannot say the same of Comedy; its early stages passed unnoticed, because it was not as yet taken up in a serious way. It was only at a late point in its progress that a chorus of comedians was officially granted by the archon; they used to be mere volunteers. It had also already certain definite forms at the time when the record of those termed comic poets begins. Who it was who supplied it with masks, or prologues, or a plurality of actors and the like, has remained unknown. The invented Fable, or Plot, however, originated in Sicily, with Epicharmus and Phormis; of Athenian poets Crates was the first to drop the Comedy of invective and frame stories of a general and non-personal nature, in other words, Fables or Plots.

Problem: in what ways are epic and tragic poems the same and different?

Historical Trace of Practices and Emergent Final Causes for Epic

[1449b9-1449b21] Epic poetry, then, has been seen to agree with Tragedy to this extent, that of being an imitation of serious subjects in a grand kind of verse. It differs from it, however, (1) in that it is in one kind of verse and in narrative form; and (2) in its length—which is due to its action having no fixed limit of time, whereas Tragedy endeavours to keep as far as possible within a single circuit of the sun, or something near that. This, I say, is another point of difference between them, though at first the practice in this respect was just the same in tragedies as epic poems. They differ also (3) in their constituents, some being common to both and others peculiar to Tragedy—hence a judge of good and bad in Tragedy is a judge of that in epic poetry also. All the parts of an epic are included in Tragedy; but those of Tragedy are not all of them to be found in the Epic.

Chapter 6

Stage 4 a, b, & c – Reformulation of the science by the techniques of Definition and Analysis of the parts of Tragedy. Problems: what is the phenomenal essence of the best and most noble species of imitation? What are the proper functions of this species?

a) Formulation of the Essential Definition of Tragedy According to the Deeper Poetic Phenomena Made Apparent by the Cross-Differentiation of Four Causal Factors of poetic agency.

[1449b22-1449b31] Reserving hexameter poetry and Comedy for consideration hereafter, let us proceed now to the discussion of Tragedy; before doing so, however, we must gather up the definition resulting from what has been said. A tragedy, then, is the imitation of an action that is serious and also, as having magnitude, complete in itself; in language with pleasurable accessories, each kind brought in separately in the parts of the work; in a dramatic, not in a narrative form; with incidents arousing pity and fear, wherewith to accomplish its catharsis of such emotions. Here by 'language with pleasurable accessories' I mean that with rhythm and harmony or song superadded; and by 'the kinds separately' I mean that some portions are worked out with verse only, and others in turn with song.

b) Analysis of the Causes at Work in the Tragic Species as a Whole into a System of Six Functional Parts that Produce the Effects Essential to Tragedy

> [1449b32-1450a14] I. As they act the stories, it follows that in the first place the Spectacle (or stage-appearance of the actors) must be some part of the whole; and in the second Melody and Diction, these two being the means of their imitation. Here by 'Diction' I mean merely this, the composition of the verses; and by 'Melody', what is too completely understood to require explanation. But further: the subject represented also is an action; and the action involves agents, who must necessarily have their distinctive qualities both of character and thought, since it is from these that we ascribe certain qualities to their actions. There are in the natural order of things, therefore, two causes, Character and Thought, of their actions, and consequently of their success or failure in their lives. Now the action (that which was done) is represented in the play by the Fable or Plot. The Fable, in our present sense of the term, is simply this, the combination of the incidents, or things done in the story; whereas Character is what makes us ascribe certain moral qualities to the agents; and Thought is shown in all they say when proving a particular point or, it may be, enunciating a general truth. There are six parts consequently of every tragedy, as a whole, that is, of such or such quality, viz. a Fable or Plot, Characters, Diction, Thought, Spectacle and Melody; two of them arising from the means, one from the manner, and three from the objects of the dramatic imitation; and there is nothing else besides these six. Of these, its formative elements, then, not a few of the dramatists have made due use, as every play, one may say, admits of Spectacle, Character, Fable, Diction, Melody, and Thought.

c) Higher Order Philosophic Reformulation of Tragedy in Terms of 'Plot,' which has its own Productive Parts, as the Architectonic Poetic "Life-Form" for the Species

The Scientific idealization of 'plot' as central term for poetic synthesis. Problems: Which part(s) provide(s) the architectonic structure of Tragedy? How is the form of tragic art realized through the exercise of higher-order cathartic functions throughout all the parts?

> [1450a15-1450b21] II. The most important of the six is the combination of the incidents of the story. Tragedy is essentially an imitation not of persons but of action and life, of happiness and misery. All human happiness or misery takes the form of action; the end for which we live is a certain kind of activity, not a quality. Character gives us qualities, but it is in our actions—what we do—that we are happy or the reverse. In a play accordingly they do not act in order to portray the Characters; they include the Characters for the sake of (*télos*) the action. So that it is the action in it, i.e. its Fable or Plot, that is the end and purpose of the tragedy; and the end is everywhere the chief thing. Besides this, a tragedy is impossible without action, but there may be one without Character. The tragedies of most of the moderns are characterless—a defect common among poets of all kinds, and with its counterpart in painting in Zeuxis as compared with Polygnotus; for whereas the latter is strong in character, the work of Zeuxis is devoid of it. And again: one may string together a series of characteristic speeches of the utmost finish as regards Diction and Thought, and yet fail to produce the true tragic effect but one will have much

better success with a tragedy which, however inferior in these respects, has a Plot, a combination of incidents, in it. And again: the most powerful elements of attraction in Tragedy, the Peripeties and Discoveries, are parts of the Plot. A further proof is in the fact that beginners succeed earlier with the Diction and Characters than with the construction of a story; and the same may be said of nearly all the early dramatists. We maintain, therefore, that the first essential, the life and soul, so to speak, of Tragedy is the Plot; and that the Characters come second—compare the parallel in painting, where the most beautiful colours laid on without order will not give one the same pleasure as a simple black-and-white sketch of a portrait. We maintain that Tragedy is primarily an imitation of action, and that it is mainly for the sake of the action that it imitates the personal agents. Third comes the element of Thought, i.e. the power of saying whatever can be said, or what is appropriate to the occasion. This is what, in the speeches in Tragedy, falls under the arts of Politics and Rhetoric; for the older poets make their personages discourse like statesmen, and the moderns like rhetoricians. One must not confuse it with Character. Character in a play is that which reveals the moral purpose of the agents, i.e. the sort of thing they seek or avoid, where that is not obvious—hence there is no room for Character in a speech on a purely indifferent subject. Thought, on the other hand, is shown in all they say when proving or disproving some particular point, or enunciating some universal proposition. Fourth among the literary elements is the Diction of the personages, i.e. as before explained, the expression of their thoughts in words, which is practically the same thing with verse as with prose. As for the two remaining parts, the Melody is the greatest of the pleasurable accessories of Tragedy. The Spectacle, though an attraction, is the least artistic of all the parts, and has least to do with the art of poetry. The tragic effect is quite possible without a public performance and actors; and besides, the getting-up of the Spectacle is more a matter for the costumier than the poet.

Chapter 7

<u>Stage 5</u>

Beginning of the Scientific Exemplification of a Poetic Synthesis of Good/Beautiful Plots (chs. 7- 19)

[1450b22-1451a15] Having thus distinguished the parts, let us now consider the proper construction (<u>σύστασιν</u>) of the Fable or Plot, as that is at once the first and the most important thing in Tragedy. We have laid it down that a tragedy is an imitation of an action that is complete in itself, as a whole of some magnitude; for a whole may be of no magnitude to speak of. …

Interpretive Scene II: ***Introduction, Exegetical Project Goals, and Results***

> "The history of actual scientific advance is marked by the adoption and invention of material devices and related techniques: – of complex and refined forms of apparatus and definite related techniques of using apparatus. … [Such advances] institute a new order of problems whose solution requires a new frame of conceptual reference."
>
> (John Dewey 1938, p. 391)

Introduction to the Problematic Situation, and Project Context Setting

The project reported in this Overview began with a rigorously close word-by-word reading of the opening chapters (1-6) of Aristotle's *Poetics* as a productive science that gains warrant by then looking for coherences and implicit significances across different "spots" or portions of text. This close reading explicitly takes the reader's own process of interpretation as a critical testing arena of possible understandings – from whatever source – against the discourse of the text, with the goals of fully reconceptualizing and reenacting the argument of the *Poetics* as a whole. The interpretation of the *Poetics* that emerges is quite different from the received tradition, but not necessarily at odds with its insights. It presents Aristotle's discourse – even on poetry – as being more scientific from a modern perspective than is usually credited, and finds much greater order and coherence to his scientific methods as sequenced in continuous argument than is traditionally attributed to "student notes" (i.e., of Aristotle's lectures). Undoubtedly, this interpretation has been heavily influenced by my engagement with modern science, yet that sort of condition is a situated fact for all interpretation. Here it is explicitly made part of the iteratively critical process of reconceptualizing and reenacting the argument of the text as a whole.[1]

This overview gives a more concise (although decidedly not short) view of where the project, as a study of one Aristotelian science as a whole (*poiêtikês aủtês*), is aimed and has led. The subsequent exegesis of the *Poetics* develops my interpretation by making the particular determinations of single scientific terms brought to utterance and related in specific methodological contexts that cohere through argumentative development in Aristotle's discourse. Accordingly, this overview will already use and refer to Aristotle's transformations of Greek vocabulary (Dewey 1938, chs. III, IV, V) into key scientific terms and concepts such as "species (*eỉdôn aủtês*)," "cause (*aitía*)," and "concrete, composite whole (*tò súnolon*)," as I have determined them in the exegesis.

The story or interpretive narrative of the Overview

The story or connecting theme for the overview is one of participating and innovating in a tradition of interpreting Aristotle's contributions to the origins of empirical science as a source of conceptual techniques and empirically grounded organizations of the phenomena of nature as

[1] For treatment of such a whole, see also Dewey's concept of the "tertiary quality of a situation" such that the "… qualities permeate and color *all* the objects and events that are involved in an experience." And "A painting is said to have a quality, or a particular painting to have a Titian or Rembrandt quality. The word [quality] thus used most certainly does not refer to any particular line, color or part of the painting. It is something that affects and modifies all the constituents of the picture and all of their relations. It is not anything that can be expressed in words for it is something that must be *had*. Discourse may, however, point out the qualities, lines and relations by means of which pervasive and unifying quality is achieved. But so far as this discourse is separated from *having* the immediate total experience, a reflective object takes the place of an aesthetic one." (Dewey 1938, pp. 66-71. Underlining mine.). Aristotle's productive science works between the "pointing in active experience" and the "reflective determination of the object" as different modes of formulating the empirical phenomena of poetics in argued discourse to present ways useful for artists making imitative artifacts as such.

given to human experience. In my view, the need for such a project arises from our present culture's loss both of an understanding of the expressive power of extended discourse exemplified in Aristotle's sciences *and* of the teleological character of the human condition assumed by Aristotle's philosophy. These losses become important issues because we currently stand at such a pinnacle of scientific and technological achievement that our era seems to be a time when we could escape from all the suffering, difficulties, and limitations for the bulk of humanity around the world. If so, this pinnacle of achievement would seem to offer an escape from tragedy, and accordingly from comedy as well, due to their paired capture of the opposites of human events. Such optimism, however, does not capture the facts on the ground around the world.

What then might be a thread of the wider story of how such a diremption of expectations and actualities could have arisen? It would have to be a story of how both progress and loss have occurred. I will claim that the science of Aristotle's founding of poetics with its close connections to the Greek cultural phenomena of art can give us an heuristic beginning point for tracing the rise and achievements of modern science and mathematics, even as that rise is paired with a gradual obscuring of our capacities to formulate the qualitative activities of pursuing virtuous purposes with their consequent culminating or completing experiences. The project attempts to show how Aristotle's discourse – on the differentiation of poetic species or genres; the definition of the most imitative and noble species, namely, Tragedy; and the synthesis of tragic plots around the reconstitution or catharsis of the unresolved problems or unreached completions of situated human lives – can give us a secure starting point for a contemporary returning to inquiries into the qualities of agents acting and their qualitatively causal relationships in the course of human events in producing and performing artifacts.

With Aristotle's qualitative, discursively argued, and concretely empirical starting point as exegetically secured (in Interpretive Scene III), I will develop a series of increasingly formal models of Aristotle's method of causal differentiation to tell one story about how we have conceptually reduced the qualities of the actions of agents and their causal relationships out of our sciences. While we like to think we have thereby "eliminated" the messy subjective qualities in favor of a rigorously non-anthropomorphic objectivity (Dewey 1938, pp. 65-66), what we have actually achieved is to problematize them on a much higher level of difficulty. In effect, by identifying with such formal objectivities, we have succeeded in losing the meaningful qualitative senses of our community and self-MacIntyre 1981). Put in its best possible light, what we have achieved is a radically new and problematic situation wherein lie enriched possibilities for human activities and expression, but only if we can turn our inquiries and researches towards them in a fundamentally purposeful way – a "telic turn," if you will. This turn towards awareness of and productive engagement with purposiveness in today's culture may then help us to better understand some of the problems we face.

"Saving the phenomena" in empirically grounded functional accounts
as *arithmoi* of phenomena

The current story begins with my attempt to provide an account of the scientific narrative (R. Richards 1992)[2], or argument, of Aristotle's *Poetics*. That account then serves as a basis to

[2] I am here adapting Richards' "five aspects of narrative accounts: the events narrated, the perspective and authority of the narrator, the temporal dimensions of narrative, its causal bindings, and its explanatory force" (p. 23ff.) to the purposes of exegetical study of Aristotle's scientific development of poetics as a productive activity. Roughly speaking, the exegesis adapts the "events narrated" as the argumentative steps or developments in the text; "the perspective and authority of the narrator" become Aristotle the scientist studying the endogenous phenomena of Greek poetic art with an aim to enhance imitative making; "the temporal dimensions of the narrative" as primarily constituted by the discursive sequence of the unfolding argument – the "time" of the text if you will – along with some historical contextualization for "number" and

determine Aristotle's mode of numeracy as implicitly embedded in his causal system of poetic phenomena. I name that mode in general "*arithmoi* of phenomena,"[3] because instances of it

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"science," and other concepts in ancient Greece; "causal bindings and explanatory force" become the disclosure of Aristotle's use of the system of four causes to differentiate and otherwise formulate the species of poetry; and the "explanatory force" of Aristotle's discursive argument as hinging on the continuity, phenomenal integrity, conceptual richness, and scaffolding-enhanced imitative making in extended discourse through the "productive ambiguity" that philosophy affords poetics. In short, I intend to present what Richards determines as "The Structure of Narrative Explanation" through the precisely disclosed 'heuristic reconceptualization' and 'procedural reenactment' of the text as such through that method of interpretation. I hope to disclose the very high "index of reality" that Aristotle's scientific argument carries from ancient Greece to the present with a recurrent "power of historical triangulation." But we will have to discover for ourselves the evidence of a recovery of Aristotle's science, as the interpretation looks to the *Poetics* from the "perspective of the future."

[3] *Arithmos* or "number" was the Greek manner of concrete numeric references to actual things in the world (Heath 1949, Klein 1968; Hopkins 2011; Halper 2015; Stein 1990) <u>that cannot be formally separated from their numeration.</u> A key example of what I mean by an "arithmos of phenomena" is Aristotle's differentiation of the species of art via the system of the four causes as they variously co-function in works of art. This interpretation of Aristotle's method of species differentiation according to the system of the four causes presents the unity underlying the coherence of bringing the *many species-themselves* into *one quasi-genus of "poetics-itself"* as a mode of "counting" according to kind of cause. I am calling this mode of counting an '*arithmos* of phenomena.' Its function is to organize the complex of actual phenomena presenting a multiplicity of aspects into overlapping but nonetheless separable species. The '*arithmos'* is really a reflection of the unity of the thing studied under causal analysis. This interpretation is <u>not</u> to say that Aristotle attributes the number four to the substance of a science per se; that would put "four" *into* the being of the substance as such. Nor is it to assert that there are four separable components or elements in the substance as a real thing that might somehow be divided out in reality. To assert those interpretations would be to violate Aristotle's critique of the Platonic Ideas and the Pythagorean *tetractys*, among other Greek conceptions (*Met.* 1080a10-1086b12). Rather this interpretation is to assert that it is possible to abstractly separate different sorts of causal factors at work in a substance *in thought for the purposes of definition*.

Aristotle's critiques of prior theories of causation lead him to posit a system of four kinds of causation adequate to capture the unified definition of a substance. Here then we have a "four-in-thought" that depends on and refers to the unity of the thing as scientific subject matter. Aristotle's innovations within an *arithmos* mode of reference places the reality of the individuals constituting the substance prior to any numeration of those individuals *and* also places a <u>methodological intermediary</u> between the substance and the systematic determination of the substance's properties, and thereby leading to essential definition. It is in this sense I speak of an "*arithmos* of causation," or in a different example, an "*arithmos* of whole-part functional relationships within a substance," as seen in his division of Tragedy into six co-functioning parts.

A further step, then, is to generalize Aristotle's innovation with regard to a "methodological-numeration" according to a specialized scientific technique into the possibility for other kinds of *arithmoi* determined by a variety of different methodological-numerations. I suggest the term "*arithmos* of phenomena" for such a pairing of methodological-technique and empirically sustained phenomenal coherence. For the *Poetics* then, we have a scientific concept or theory: [Genus | Species] with its essential grasping of common or shared causal factors [material | formal | efficient || final] for all the species that is then *systematically differentiated* according to the particular combinations and elaborations of the causal factors inherent in the phenomena into identifiable species of poetry, each with its own definition. The additional critical component required for constituting an empirical scientific account is to structure the system of causal factors according to the particular properties of each kind of cause *in terms of specialized contrary ranges for the specific properties inherent to the phenomena of the given substance*, such as formal causation along the range of [noble | as we are (average) | base] actions performed by the agents being imitated. These properties actually inhere in the thing itself, and are arranged or ordered by the contrary "measure." They are "saved" by the method and the specialized contrary content. Thus Aristotle's sciences retain a mode of *referential arithmos* between the things referred to and the unity of the kind of thing that is "enumerated" through a methodological intermediary, i.e., a scientific technique that uses number to organize the phenomena in question – without ever attributing "four" to the thing itself. Moreover, Aristotle does not break the numeracy of *arithmos*; he takes advantage of his understanding of number as neither separable from existing things, nor "in them" as "numbers present in the things" (*Met. xiii*, 1080b4-7), to find a way of organizing or patterning a scientific technique or procedure that is adaptable for investigating the different kinds of things with their peculiar substantive phenomena.

Admittedly, "*arithmos* of phenomena" is a hybrid term. It disengages from our modern strict sense of "number" as we project that back to a time (i.e., ancient Greece) without a rigorous self-grounded mathematical language in order for us to reconceptualize "ordering relationships" within Aristotle's discourse. At that time, the numerological term "*tetractys*" was commonly received as a high-level ordering concept for both arithmetic and nature (Heath 1963, pp. 42-43) and further developed by Plato, leading to his theory of ideas. My assertion is that Aristotle's science shifts from the culturally prevalent numerology of the *tetractys* to the systematically empirical science of causation or other unified functional organization. Aristotle:

> "And this is reasonable; for the one means the measure of some plurality, and number (*arithmós,* ἀριθμός) means a measured plurality and a plurality of measures." (*Met. XIV (N),* 1, 1088a4-6. See also 1087b33-1088a14, and surrounding arguments.)

This hybrid term for numeracy in Aristotelian science, as having a *conceptually integrated numerical and qualitative character* (*póswn kaì poíwn, Poet.* 1. 1447a12), helps to afford us a better understanding of how he pushed the tradition to a greater scientific rigor that better recognized the natures of different kinds of things. In that way we can re-engage Aristotle's science for application to our current problems using both the fully mathematized sciences *and* an empirically discursive science to point out a rigorous mode of empirical accuracy that conceptually "saves the appearances" as they are actually encountered in experience in ways no longer envisioned as possible.

organize the phenomenal qualities and numeration of parts into coherent groups of contrary scales or other measures of human experience that overlap and function together to provide enhanced discernment and purposive ordering (Collingwood 1933). At the center of this story is the goal of recovering Aristotle's use of what we moderns call "scientific terms" as they are given structure and significance *within his text*. As moderns, we theoretically restrict scientific terms to having one significant reference to one nominally determined thing in the world. Kuhn (2012, 2000) and many others originally applied the highest logical language constraints on such a one-to-one mapping of symbol to thing for scientific terms in the hope of attaining a unified encyclopedia of knowledge. While that goal has slipped, the theoretical expectations remain relatively unmodified.

In contrast, Aristotle's empirically scientific terms for qualitative phenomena retain their polyvocal reference to and articulation of the manifold qualities of poetic experience,[4] both in the

[4] Gendlin (2012, p. 234, Endnote 15) gives an example of such operative polysemy for the famous variety of meanings for the word "logos." It is important to realize that Gendlin is identifying *Aristotle's specialized meanings for "logos" within his science*, not just an assimilation of common Greek or even Platonic usage at his time. These different senses are technically precise variations within the coherence of his use of "logos," not disparate dictionary variations, suggestive as those might be.

> "'**logos**'. This term can mean a verbal account of the thing, or it can mean that which a verbal account would tell, i.e., what is proper to that thing. Aristotle uses another word (*horismos*) for a merely verbal definition. He knowingly uses "logos" both ways. [continues next page]
> "'Logos' means proportion, proper account of that which makes a thing what it is, but it also means definition, formula, account, and it can also have some other meanings. There are many English translations of it, and no quite right one. Combine "a proper account," "definition," "what something is," "what we would properly say of it" and "its proportions," and you come close. But we must keep in mind that it is a single word which brings all these meanings. They are not separate meanings. The context interacts with the word to generate its specific meaning in any one spot. The whole complex of meaning is brought by the word in each use. One gradually comes to understand the import of this word."

significances of a given scientific term and in the 'discursive associativity' between specialized terms provided by argumentative discourse. One exegetical purpose, then, will be to disclose this power of polyvocal expression as a *substantively productive ambiguity* located in the terms Aristotle used to found and develop his science (see Scene III). This productive ambiguity is akin to that of an axiom system, but is determined for an empirical science of phenomena rather than a field of mathematical objects.[5, 6] This distinction leaves us closer to Aristotle's separation

See also McKeon 1936 (1952).

[5] For the sake of establishing conceptual rigor for the term "productive ambiguity" as a positive feature of discourse see: Grosholz, Emily R. *Representation and Productive Ambiguity in Mathematics and the Sciences.* Clarendon Press; 1 edition (October 18, 2007), chs. 1 and 2, esp. 1.2 & 1.3. Of course, Aristotle's discursive science is not mathematical in Grosholz's sense, but it should be clear that *extended argument* could also take advantage of such communicative power as Grosholz reports it.

See: Grosholz 2007, p. 23, with regard to the productive ambiguity made possible by returning all three linguistic aspects of syntactics, semantics, and pragmatics to the interpretation of science. The interest here is how these aspects can give rise to higher-order conjunctions of meanings that are conceptually coherent even within their variability. This concept is a more exacting notion of "polysemy" than that of dictionary entries which have many, often conflicting meanings and uses. Today's readers often assume that this plurality is univocal rather than polyvocal. For example, in Aristotle's poetic species, the fact that multiple species are unified by genus criteria for the base or noble characters of the agents imitated is too easily taken reductively to be strictly univocal per species. I will show that in extended discourse, multiple aspects of significance can be in play around a single species such as the [whole | part] relationships it has with regard to the genus as a whole, on the one hand, and its own internal structures and functional parts, on the other. The multiplicity of species in this genus has all such relationships in interaction with each other in higher-order significances not reducible to any one of them, nor to their fulfilling criteria for being a species. Such relationships are concretely tied up in phenomenal presentations, as well. Again for example, both tragedy and comedy share the same means of imitation (rhythm, speech, and harmony) and artistic manner (dramatic), while being differentiated by their objects of imitation: noble versus base agents and actions. Aristotle's scientific discourse brings all that into a systematic order with multiple overlapping expressions.

[6] I also want to make clear that I do not intend to limit the concept of "productive ambiguity" to human mathematicians and discursive principles. For example, it is also clear that computing processes can calculate truth functional relationships that draw out significant results in ways not available to people through math or discourse. Turing engaged with the Typewriter as a productively ambiguous mechanism and thereby concretized the theory of computing. Then, within the Turing frame of computing, machines are capable of producing new formalisms that

between the mathematical versus the empirical sciences, where his philosophical attention to and "saving" of the qualitative phenomena of experience was the first to ground a science of substances as distinct from a science of forms. Yet this concept of a substantively productive ambiguity leaves us with a gap between ancient and modern modes of numeracy (Dewey 1938, p. 77). I hope to characterize this gap as framed by two different kinds of "scientific terms": one kind which capitalizes on the deeply expressive powers of extended natural language discourse and its capabilities for organizing phenomena, and the other kind which capitalizes on the highly formal orderings of mathematics and especially the effective agencies of computer programming languages.

Statement of Our Culturally Problematic Situation as a Contrast between Modern and Aristotelian Scientific Terms

This gap between natural language and formal language is of greater urgency than a scholarly return to Aristotle might seem to indicate. In order to historicize this problem, I turn to John Dewey's formulation of it in his *Logic: The Theory of Inquiry*. In part, I intend to disclose both how similar and how different our current situation is even to Dewey's, since his time and our time share very closely related concerns. In an early twentieth-century recognition of the changes of common-sense appearances wrought by scientific advances, Dewey focused on these changes as a social-cultural problematic. While he spoke between the world wars in the contexts of rapidly advancing physical science and a flourishing of new manufacturing, we are now situated in rapidly advancing biological and computer sciences, with tremendous changes in work and life patterns due to their technological innovations, along with continued advances in

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we would not be able to calculate or would not come to through human intuition without the aid of computing.

physical science. I quote from Dewey's *Logic* below at considerable length in order to recapture his formulation of the gap in question, as a way of further contextualizing the problematic of this project. I indicate in italics some of the recurrent problems with regard to these aspects: new phenomenal qualities as yet not coherently organized through further cultural articulation and development; the increased obscurity of teleological concerns as we continue to hold to a strict separation between "facts and values" rather than productive ambiguities between them; and the existence – now even more deeply entrenched – of "two different families of languages" made literally true with the rise of formal programming languages.

> Applications of science in revolutionizing the forces and conditions of production, distribution and communication have of necessity tremendously modified the conditions under which human beings live and act in connection with one another, whether the conditions be those of interchange and friendly association or of opposition and war.
>
> *It is not intimated that the incorporation of scientific conclusions and operations into the common sense attitudes, beliefs and intellectual methods of what is now taken for granted as matters of common sense is as yet complete or coherent.* The opposite is the case. In the most important matters *the effect of science upon the content and procedures of common sense has been disintegrative. This disintegrative influence is a social, not a logical, fact.* But it is the chief reason why it seems so easy, so "natural," to make a sharp division between common sense inquiry and its logic and scientific inquiry and its logic.
>
> [One aspect of disintegration] is the fact, …, *that common sense is concerned with a field that is dominantly qualitative, while science is compelled by its own problems and goals to state its subject-matter in terms of magnitude and other mathematical relations which are non-qualitative. The other fact is that since common sense is concerned, directly and indirectly, with problems of use and enjoyment, it is inherently teleological. Science, ..., has progressed by elimination of "final causes" from every domain with which it is concerned, substituting measured correspondences of change. …*
>
> The subject-matter of science is stated in symbol-constellations that are radically unlike those familiar to common sense; in what, in effect, is *a different language*. … In the region of highest importance to common sense, namely, that of moral, political, economic ideas and beliefs, and the methods of forming and confirming them, science has had even less effect. … These considerations fix the meaning of the statement that the difference that now exists between common sense and science is a social, rather than logical matter. *If the word "language" is used not just formally, but to include its content of substantial meanings, the difference is a difference of languages*.
>
> …
>
> *The paths of communication between common sense and science are as yet largely one-way lanes*.

> …
>
> With respect to the … point, that of a seeming fundamental difference [between science and common sense is] due to the fact that common sense is profoundly teleological in its controlling ideas and methods while science is deliberately indifferent to teleology, it must be noted that in spite of the theoretical difference, physical science has, in practical fact, liberated and vastly extended the range of ends open to common sense and has enormously increased the range and power of the means available for attaining them. … *Invention of new agencies and instruments create new ends; they create new consequences which stir men to form new purposes.*
>
> …
>
> *Instead of science eliminating ends and inquiries controlled by teleological considerations, it has on the contrary, enormously freed and expanded activity and thought in telic matters.* … The same sort of thing holds of the qualities with which common sense is inextricably concerned. *Multitudes of new qualities have been brought into existence by the applications of physical* [and other] *science*, and, what is even more important, *our power to bring qualities within actual experience when we so desire, has been intensified almost beyond the possibility of estimate.*[7] (Dewey 1938, pp. 75-78. Italics and square brackets mine.)

In returning to Aristotle's "*arithmoi* of phenomena," my intent is not to restore a sense of "ends [that] were static and fixed by nature," but rather to recover Aristotle's concepts and methods of scientifically organizing qualitative phenomena that have generally been dismissed as not really scientific because of their non-modern numeracy, especially since it is expressed in un-mathematized natural language with strong teleological import. In order to bridge to modern numeracies and open up a more flexible notion of ends as 'teleological consummatory acts', I

[7] An example of an interdisciplinary effort to discern such novel tertiary qualities can be found in J. David Bolter's (1984) concept of "Turing Qualities." Bolter's *Turing's Man* presents a serious attempt to formulate culturally significant properties of computers and computing. He posits four defining qualities we would experience with the technology and its artifacts: 'Discrete', 'Conventional', 'Finite', and 'Isolated'. These are then implicitly compared with 'Continuous', 'Connotative', 'Infinite', and 'Immediately Related' as established qualitative experiences present in our current cultural situations. (Sterner 1989) After laying these out, Bolter attempts to assay a fresh cultural synthesis in which such emergent qualities can be assimilated to prior 'defining technologies' in the Western tradition and thereby made more evident to our common sense of the artifacts in daily experience. In his account, they turn out to evoke the craftsmanship of ancient Greek manual tool use, only now placed within the abstract plasticities, mechanical rule following, formally effective, and physical character of computerized symbol systems.

will further expand upon Aristotle's fourfold combinatoric of species differentiation through a graded series of specifically different but formally associated models of numeracy that gradually connect to our current uses of formal symbol systems on a range between *univocal* and *polyvocal* scientific terms.[8]

This opposition between univocal and polyvocal scientific terms is intelligible because, while the series of models of numeracy bridges forward historically, it may also be possible to recover aspects of qualitatively and teleologically adequate scientific discourse for present uses that would in effect also bridge backward to Aristotle's texts. Such a two-way bridge or interface could allow traversing in both directions between Aristotle's scientific terms that have the virtues of a powerful expression of qualitative ordering, *and* modern scientific terms with their virtues of higher order formal deductive closure. Rather than being Whiggish, such a return would actually be both a discursive "retention" and a "carrying forward" (Dewey 1938, pp. 114, 118, 192, 321; Gendlin 2009, throughout) of what was found in Aristotle's *Poetics* under modern conditions. As indicated above, the thematic issues will concern what is lost with regard to teleological

[8] I mean "univocal" scientific terms as they are generally construed within the context of a logical formalism or computer program that requires a single significance for truth functional or effective computational purposes. By "polyvocal" scientific terms, I mean ones that have multiple converging significances within the context of the science in extended discourse, whether this plurality derives from a single text, or from different scientists doing research using the same term (McKeon 1994, 1936; Lidgard and Nyhart (Eds.) 2017, Griffiths and Stotz 2007, Ceccarelli 1995). Also see quote from Gendlin on Aristotle's use of "logos" in a polysemic fashion in the above footnote.

I am using the polar opposite senses of this distinction between univocal and polyvocal scientific terms as a means of comparing and contrasting the respective properties of the different models with regard to qualitative and telic properties, versus quantitative and formal properties. Some may consider this pairing a literal "contradiction in terms." Perhaps so, but I believe it is an apparent contradiction that can be overcome through a wider understanding of our experiencing of our plurality of consequential communicative expressions. Both such "univocal" and "polyvocal" scientific terms have their own distinctive "higher order" coherence, the one mathematical, the other discursive, as will be developed throughout.

expressiveness along the way, and how today's argumentative discourse might still achieve and perhaps exceed such natural linguistically polyvocal powers of expression through '*hybrid' conjunctions* of the two kinds of terms, and through fresh inquiries that would advance over Aristotle's at a higher order as required by our radically new and problematic situation.

Some terminological development

As a terminological note, I need to clarify the technical term 'hybrid.' In general, my use of 'hybrid' will carry the meaning of combining two kinds of linguistic framing and significance making, those of Natural Language [or/and] Artificial or Formal Language, with parallels or oppositions, and translations and syntheses between them. For the purposes of this project, I will limit possible resources to a small group of reference sources that can provide characterizations of the two modes of linguistic expressiveness. On the formal side, Tarski's (1969) and Quine's (1950) theories of truth and inference provide a view of what of "meaning" it is possible to encode logically in formal object and metalanguages. Quine (1960) can also help characterize what aspects of significance are *not* captured in behavioristic logic since they are lost in "translation." Expressive properties of formal importance include those of well-formed symbolic terms and formulas, logical connectives, quantifications, valid rules of truth functional inference, and conceptual identity up to isomorphism. On the natural language side, a notion of what additional ranges of meanings *can* be discursively expressed arises in (or must be ferreted out of) multiple contexts including works by Collingwood, Dewey, Eco, Gendlin, and McKeon among others, as well as transitions between Aristotle's philosophical Greek and English. Expressive properties of substantive importance in extended natural language argument include a variety of inflections, polysemy, covariations of syntax and context, metapragmatics of discourse, associative linkages, scientific analogy, and polyvocality, among others, all of which I will group under ‘accidence’[9]. Of course, natural language discourse can also be truth carrying, that is, it can and does have argumentative force.

‘Hybrid’ seems a better bridging term than ‘creole’ or ‘pidgin’ because two powerfully robust linguistic forces are at play: formal languages are used to create untold numbers of

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[9] An instance of an historical use of the term ‘accidence’: “When Franklin, playing with his kite in a thunderstorm, brought down sparks from the heavens, he was learning the *accidence* of that science of Electricity which has given us the Telegraph and Telephone, and which has in store for future generations a power we can hardly as yet conceive. But how many men of his generation were there who did not regard his experiments as mere amusement, unworthy of the attention of serious persons?” (Edwin Sidney Hartland, *Popular Studies in Mythology, Romance and Folklore*, London: David Nutt, p. 67, 1904. Italics mine.) See also Gendlin’s “The Responsive Order: A New Empiricism” (1997b), and “A changed ground for precise cognition” (2009). Dewey has a related concept, ‘connexitivity’ (see below), as a kind of formal relationship between terms that evokes something of Aristotle’s concept of “convertibility” in the *Prior Analytics* and *Topics i.* 5 102a18-102a30, where “terms that cover the same range of cases (because they refer to the same nature) are interchangeable (*antistrepho*)” (https://www.iep.utm.edu/aris-log/), and his discussion of the “one middle will often serve to prove several connections” in the *Posterior Analytics*, *ii* ch. 15-18.

> 4. **Connexitivity**. Relational terms satisfy the condition of connexitivity whenever symmetrical terms are also transitive. Equivalence is, as we have seen, an instance of symmetrical transitivity, *grounding, as it were, back-and-forth movement in inference and discourse*. *The term "connexitivity" may be extended to include such cases.* Asymmetrical transitivity is exemplified in such terms as greater-than, hotter-than, and in comparative terms generally, in which terms have the relation of converse symmetry. *Connexitivity is not so much a coordinate relation as it is a complex of relations, the function of transitivity being basic in all modes of logical relation*.
>
> The discussion has been conducted upon the basis of distinctive forms of the relative and relational terms that are commonly recognized. *But these forms have been interpreted upon the doctrinal ground that the relations in question indicate either (1) formal conditions that terms (meanings) must satisfy in order to function in inquiry yielding warranted conclusions, or (2) as warnings that the conditions required have not been fulfilled.* An example of the latter would be the case of asymmetrical intransitivity or the many-many relations in which elements have not been determined to be elements in an ordered system. It is difficult to avoid the impression in reading some logical texts (even those in which the necessity of strict formalism is emphasized) *that meanings (terms) are taken just as they happen to present themselves in isolation and certain labels are then placed upon them.* (Dewey 1938, p. 335-336. Italics mine.)

computed symbolizations, while the world's populations are engaged in exponentially increasing multi-acculturalizations through natural language communications which are increasingly macaronic. This sense of 'hybrid' has a global scope beyond that of a small number of peoples synthesizing new ways of exchanging language forms and expressed meanings. 'Hybrid' also has deep semantic roots to all biological life-forms, not only to human ones, for we are increasingly realizing that life-itself does not clearly divide into fully separate species-themselves. Manifold overlaps and exchanges across the scope of living beings come to the fore as these entirely salient facts serve to indicate: how massively DNA is shared across the world of life, and that we humans cannot live at all without our microbial biomes.

Our cultural problematic as a recurrent Leibnizian dream from which Aristotle's scientific discourse can help us awaken

For a century or so, we have been chasing the Leibnizian dream of a formal solution to all cultural problems: somehow formal languages would encapsulate natural languages and make everything clear, while political, ethical, and cultural problems would fall away like Wittgenstein's ladder, even though even he later realized that does not really work. We are now faced with the massive success and/or impending failure of that formal project as the world multiplies differences and particularities in unprecedented numbers of cross-linguistic and multicultural conversations that sometimes turn into dispute and conflict. Hopefully we will engage with the fact that Descartes' Demons will not be fully dispelled by reason alone, even after our great achievements of making reason take on a higher order of mathematical rigor (Erickson, Daston, et. al. 2013). Understanding the interactions and difficulties between these two modes (natural and formal) of significance generation is tremendously exciting *and* highly problematic as we babble on "at" each other without teleological significance or worse with cruel intent, instead of for, with, and through, as well as productively against, each other in the pursuit of pluralistically flourishing in ecological community. Accordingly, my use of ‘hybrid’ will point to aspects of the problematic ‘situation’ wherein these two modes of expression are encountering each other with opportunities, pitfalls, achievements, and unintended consequences for good or ill that need to be brought into living balance.

Consequently, the discursively archaeological purpose for reading Aristotle’s science as an exemplary natural language argument possessing the above expressive powers is thereby situated at the center of engaging with our current radically renewed and freshly emergent cultural problematic. The deep encounter with a text possessed of a high degree of discursive continuity can help to keep us in touch with a “qualitative whole” (Dewey 1938, ch. IV, p. 68ff.), which we can encounter in our experiencing of the problem aspects we need to understand and seek to transform into healthy modes of life in ecological community. The discursive continuity of the *Poetics* can serve as a natural language touchstone, if you will. Engaging in this archaeological inquiry leads to a first level of several exegetical questions: “What are Aristotle’s scientific terms as discursively developed in the *Poetics*?” “How can we determine them as used in a specialized science?” “How are they related in the argument of the text?” and “What assessment can be given to the semantics and communicative strength of such complex words (Eco 2014, ch. 17, sense 5, p. 550) *for the science itself* when put into the arguments expounding that science?” When Aristotle’s specialized terms are taken together, explicating them in their argumentative context drives the project. One of the results of rigorously returning to the text again and again until certain problems clear up, as provided by the exegesis, will be that Aristotle’s scientific terms, such as ‘species’ and ‘plot’, turn out to be productively ambiguous in ways that turn such polyvocality to the service of his science of imitative making.

While focusing primarily on Aristotle's science, the backdrop of distinctions about natural and formal languages will help to initially envision how such different kinds of scientific terms can come together in new modes of extended discourse made possible by computed expressions. Of particular interest is determining how Aristotle's use and development of specialized terms in an historically original mode of extended discourse constitutes a <u>scientific discourse which "saves the phenomena" of experience</u> (Owen 1961, Nussbaum 1986). Over millennia, Aristotle's metaphysical framework of the sciences as [Theoretical | Practical | Productive][10] has opened up vast new fields of rigorous empirical inquiry which we are still working through, as well as explosively extending today into communicative hybrids inclusive of the modes of more formally numerate expressions made possible through first-order languages.

The scientific character of poetics is essentially productive *and* performative

Thus my reading of the *Poetics* is predominately one of disclosing the character of Aristotle's poetic science with its phenomena of poetic experience as entextualized through the constitution of the specialized subject matter of poetic science. I claim that this scientific character is an essentially *productive* and *performative*[11] one with continuing relevance today, and that it is exemplary in its use of polyvocal scientific terms intended to facilitate imitative making (*mimêsis poíêsis*). As noted above, I will attempt to provide a bridge or interface between the two kinds of scientific terms by exploring a two-way sequence or overlapping scale

[10] *Met.* Vi. 1. 1025b1-28; *Ethics* vi., ch. 3-4; *Top.* vi. 145a15.

[11] One way to account for the quasi-essential character of poetics for Aristotle is that artifacts do not have a completely physical independence of the artist in the way living things do. Imitative making partakes in the wider variabilities of culture, history, and technologies intrinsic to humanity. And the artifacts themselves concretize such human aspects as such, rather than being free from them.

(Collingwood 1933) of models for "species concepts" moving from a strictly discursive numeracy with its access to highly qualitative variables, to the numeracy of formal language structures that are strictly countable while theoretically based in countable infinity. I claim that both of these numeracy endpoints are real and continuing to contribute to our culture, yet each has often been presented as properly dominant or even *the universal* standard for expression. By putting these varied modes of numeracy into a range with concrete intermediate cultural loci, I hope to structure a possible multiplicity of such numeracies with respective powers of expression. This multiplicity or plurality will open up an understanding of the prolific possibilities of shifting back and forth between small finite discursive models with qualitative robustness *and* large finite models built on univocally precise terms that make possible multiple stable and culturally realizable situations in between that are subject to potentially coherent hybridization.

At root, this exegetical project aims to ask apparently familiar questions in the philosophy of science, yet asks them from the perspective of serious readers possessing the "capacity of beginning something anew" (Arendt 1958) that nonetheless arises out of prior cultural achievements. In relation to the first level of questions (above), we begin anew with a second and deeper layer of exegetical questions for Aristotle's text as extended natural language discourse by abducting into it to reconceptualize and reenact the human significances teased out of his scientific exposition:

> What are Aristotle's scientific methods? How does he practice them? What scientific concepts does he make use of when he lays out a particular science? How does he sequence his concepts to form not only factual knowledge, but also an extended argument that constitutes its scientific field of inquiry as a specialized mode of thought and research even as it is being laid out?

> How does this specialized mode of inquiry disclose what a given substance is, and what are the functional realities of the substance's behaviors as we encounter them in the phenomena of experience? And in particular, what are the human significances of the products made according to the idealizations of the productive science both as historically and culturally situated and more generally across times, places, and communities?

By means of a neoteric reading, this project interprets Aristotle's science through the semantics and pragmatics of his extended discourse as he entextualizes those concepts and methods or practices in an argumentative sequence with its own emergent syntactic structures both beyond and beneath the propositional scope. For the *Poetics,* that argumentative sequence can be resolved into interlocking stages of scientific development constituting the text as we have it, while leaving open the possibility for further elaboration by other thinkers.

Interpretive Abductions into the Text

Accordingly, I will make the following six interpretive abductions into the text. First, Aristotle has and applies or practices an empirical scientific method in his treatises. Second, this method consists of a sequence of distinguishable empirical techniques that is applied in concrete and continuous stages of subject matter transformations. Third, these stages can be made explicit through exegesis, that is, they are expressed in a recoverable, discursive *logos*, rather than a formal mathematical one. For example, following the Chicago School's reading of Aristotle with the poet being the primary agent, I will place the interpretive frame of textually separable causal accounts on chapters 1, 2, 3 as capacities of the poet in means as material factors, objects as formal factors, stylistic manners as efficient, even though Aristotle does not explicitly assert these categories. And chapters 4 & 5 which do explicitly mention of the causal character of imitation as a human universal with proper pleasures as final factors respectively of *mimêsis poiêsis*. Fourth abduction, this scientific method as a coherent practice is a genuine advance beyond Pythagorean numerology and Platonic Dialectic that is marked by its ability to "save the phenomena" of a given substance in empirically scientific discourse. For example, the Platonic *diaeresis* of the *Sophist* is insufficient to explain Aristotle's actual technique of "causal differentiation," in chapters 1-5, and also Aristotle's use of the rubric of "four causes" in a systematic way has determinate precisions that exceed the indeterminate merger of numbers and nature in the Pythagorean tetractys. A fifth abduction is that Aristotle's scientific method with its techniques as specialized to each different substance is intrinsically – as well as explicitly – teleological across the range of sciences. And sixth, Aristotle uses his scientific theory of genus-species relations to resolve issues in relation to the topos of: [one versus many], in the differentiation of phenomena and scientific definition of a substance through the use of "scientific terms" with different levels of primary versus secondary phenomena, i.e., some causes are more "primary" according to nature than others.

For the given particular text of *Poetics*, 1-6, with these exegetical questions and abductions in mind, I develop a heuristic schema of a sequences of stages of scientific development as useful for disclosing discursive syntactics, semantics, and pragmatics which are intrinsically open to being interpreted in more than one way, even as the contesting plurality of readers struggle to converge on one larger understanding. Viewed with this schema, each successive stage of Aristotle's exposition in *Poetics*, 1-6 further determines, reorganizes, and reformulates the poetic phenomena according to the current scientific task and its particular techniques at hand within its own specialized scientific procedure. In contrast to the entire argument of the *Poetics*, the present project concerns just the first four of the six stages in the sequence of separable scientific tasks in *Poetics* 1-6. [12]

[12] See the above copy of Bywater's translation of 1-6 with the stages of argument, and their developmental mileposts as methodological stages.

Poetics 1-6 performs four discernable scientific tasks

In *Poetics* 1-6, the first four scientific tasks consist of the following steps. i) A joint determination of the proper theoretical frame and the terminological capture of the actually occurring primary phenomena of the science of poetics-itself (Greek sentences 1 & 2). ii) The differentiation and coincident evaluation of the range of poetic species according to three of their functionally different causal origins – means, objects, and manners (chs. 1-3). iii) A "telic scientific history" of the emergence of the three most important species – tragedy, epic, and comedy – according to a fourth, teleological causal origin that also provides causal orderings for the first three as well at aiming at cathartic effects. These cathartic effects arise from the universal human capacities for imitation and learning as exercised by Aristotle's culturally situated history of poetic invention and improvisation (chs. 4 & 5). Next, iv-a) the essential definition and iv-b) formal analysis of the functional parts of the most important species, tragedy, as a conceptual and phenomenal whole in itself; and then, iv-c) a higher order reformulation of plot as the architectonic part of tragedy (ch. 6) that is productively ambiguous and therefore provides scaffolding for the inventions of poets.

Aristotle's sequence of grounding scientific procedures and higher order reformulations (chapters 1-6) then provides the essential basis for a fifth stage of scientific procedure (chapters 7-22), which starts the science anew according to a technically idealized process of imitative synthesis aimed at enhancing the proper functioning and pleasures required for the tragic catharsis of pity, suffering, and fear through the performances of Tragedy-itself as a species of poetic making. Here we find an organization of possible tragic schemas and techniques as generating the teleological possibilities or potentials for individual and social catharses *without* *determining them in specific*.[13] The *Poetics* then closes in a sixth stage (chapters 23-26) by resolving the similarities and differences of the epic and tragic species, stating what are the appropriate standards that poets should reach for in both genres, and laying down the criteria that critics should judge them by.

The key point of highest significance here is that these "scientific tasks" are not willy-nilly assemblages of ad hoc observations. They are *performed* according to determining and organizing scientific procedures adapted to the subject matter under inquiry in a given science and developed through the argument. Aristotle's techniques as such, especially in their powers for organizing qualitative characteristics, have not received adequate treatment. Because these techniques organize the phenomena of experience (common sense and scientific) according to their appearances and the valuations we bring to them as much as discover in them, they provide insights into new methods of inquiry capable of modifying our habitual understandings of that experience as well as providing newly stabilized forms for our experience. These techniques provide us with scientifically constituted transformations of experience that are "patterned" modes of inquiry as "checked and controlled by knowledge of the kinds of inquiry that have and have not worked" (Dewey 1938, ch. VI), and thereby can deal with emergent problems and conflicts in better ways than before. These techniques help us form the hows and the whys required for problem resolution and renormalization. Contemporary problem discussions make reference to this sort of standard and procedure for inquiry when they refer to 'evidence-based decisions' that actually modify problematic situations.

[13] Not only is poetry more philosophic than history (*Poet.* 9. 1451b5 ff.), philosophy is more philosophic than poetry.

<u>Performative arguments produce</u>
<u>higher order grasping of phenomena and distinctive arrangements for them</u>

Aristotle is assiduously attached to the actual plays of his time and their poets as endogenous phenomena to be "saved" (Nussbaum 1986). He does not dictate any actual poetic content either as particular stories or reversals and recognitions. Rather he presents a higher order framework for artists to synthesize their own particular plots according to their own sensibilities and concerns. In that sense, the *Poetics* analogically frames the work of the play as both aimed at a humanly completing or consummatory act, and yet is 'open-ended' about it. As a productive science, the *Poetics* leaves the imitative making in the hands of the actual poets with all their particular individual sensitivities, social conditions, and cultural matrix when creating poems that ultimately depend upon the responsiveness of the audiences for their completing effects. This is one reason why the *Poetics* is still engaging in our time. Both poetic science and actual poems are heuristic: they are aimed at enabling citizens to discover and enact something for themselves as they realize who they actually are through the catharsis of the conflicts found in the plot or action of the work of art. Plots are teleological in their reaching for particular lived instances of human universals as embedded in a particular cultural context through the imitative actions of the play. In that sense, plots are only re-presenting active-media-as-life-informing, and do so in ways in which the audience members find their own particular completions, if they can. Poetic work (not advertising or propaganda) is an enabling and leading of the audience for *its own sake* (a property Dewey associates with scientific research), not a controlling of the audience. The freedom from determinate controlling concepts is critical to artistic significance, even as artists take in their surrounding cultural interests and problematics. Aristotle's productive science achieves this higher order framework for "saving the phenomena" by developing a distinctive mode of empirical science. I suggest it was through a very different mode of numeracy.

To better comprehend Aristotle's productive science of poetics as well as to re-encounter techniques that save (rather than abstract from) the phenomena of experience, we must ask how did his philosophy achieve an empirically grounded, specialized yet systematic sequence of methods or techniques to differentiate and grasp varied objects and subjects? My assertion is that Aristotle's science shifts from the culturally prevalent numerology of the *tetractys* to a systematically empirical science of causation as well as other unified functional organizations of phenomena. In contrast to his predecessors' use of numeracy, Aristotle's philosophy grasped phenomena in a very different mode: his scientific methods use causal systems or – as I term them - '*arithmoi* of phenomena' in his treatises.

A mildly Historical Narrative about Numeracy and the Possible Origins of Aristotle's Scientific Methods as 'Arithmoi of Phenomena' used as Tools to Ground the Determinations of Empirical Essences found in our Experience of Phenomena

The ancient Greek mode of numeracy referred to as *arithmos* (*arithmós*, ἀριθμός) is a term used to refer both to "number" and to a mode of apprehending things through numeracy. The *arithmos* of some thing or things is a mode of significance creation in which any relationship of actual things to mathematical forms – arithmetic and geometric – required an explicit enumeration or geometric figuration that is already given as fundamentally connected to *concrete, actual things in the world* that are to be counted or configured, (e.g., *Phys. IV*, 14, 224a2 ff., *Met*. *XIV*. 1, 1088b35-1088a14). In contrast to the Arabic numeral system, designating "3" for the Greeks did not mean a particular number in a countably infinite sequence of integers[14], although Aristotle understood that march of whole numbers as characteristic of number itself. "3" or "Γ" or even "∴" meant "three" *somethings*, "three" apples, etc.[15] (Heath 1949, Klein 1968; Hopkins 2011; Halper 2015; Stein 1990, Dewey 1938 p. 397). In what follows I will use Aristotle's development of methods of an empirical science of phenomenal appearances as a lens into what the fourth century BCE Attic Greeks had as a "common sense habitus"[16] for numeracy around the notions of "*arithmos,*" the Pythagorean Tetractys, and the determination of the essential phenomena of poetic genres.

In Aristotle's philosophy, in contrast to his predecessors, I propose that the "4" of the system of "four" causes has the phenomenal properties of and their integrated functioning in the substance being treated as a referential unity potentially had in our experience of the real things, *not* their "4-ness" *nor* some other strictly mathematical relation as essential to the phenomena. The functional system of causes "taken together" as an *arithmos* of four uniformly captures their cross-cutting phenomenal unities for the whole genus of poetics-itself, thereby providing an account of the phenomenal properties that appear in the things in question as potentially unifiable

[14] The Greek system of numbers went up to the myriad (μυριάς) or 10,000, which was taken to be something of an upper limit.

[15] Jacob Klein presents this conceptualization of Greek *arithmos*:

> "The fundamental phenomenon which we should never lose sight of in determining the meaning of arithmos is counting, or more exactly, the counting-off, of some number of things. These things, however different they may be, are taken as *uniform when counted*; they are, for example, either apples, or apples and pears which are counted as fruit, or apples, pears, and plates which are counted as "objects." Insofar as these things underlie the counting process they are understood as of the same kind. That word which is pronounced last in counting off or numbering, gives the "counting-number," the arithmos of the things involved. … Thus the arithmos indicates in each case a definite number of definite things. It proclaims that there are precisely so and so many of these things. It intends the things insofar as they are present in this number, and cannot, at least at first, be separated from the things at all." (Klein 1968, p. 46ff. Italics mine.)

[16] See footnote 53 in Scene III, p. 197 for further semantic background.

into the "essence" of that substance. Only through the scientific procedure of species differentiation is it possible to grasp each one as a species-itself under *and* amidst the phenomenally real differences of all the species-themselves as actively unified by the quasi-genus of poetry as a whole. It is this manifold unity of structure and function for poetics as developed through a 'continuity of inquiry' (Dewey[17] 1938, ch. XXIII), not the fact that it happens to be thought in "four" categories for noticing phenomena, that gives us an organization of their qualitative characters through the *significations of the causal factors shared by all of poetics as an organized whole.* Such a whole can only emerge in that specialized situation of scientific inquiry into poetry with its localized theory of the subject matter, viz. quasi-genus [vs.+] species, *and* an integrated sequence of scientific methods: conceptual foundations ⇒ causal differentiation ⇒ species definition ⇒ analysis into parts ⇒ higher order reconceptualization ⇒ synthesis of knowledge ⇒ resolution of problems. Aristotle's productive science of poetics is a rigorously regulated inquiry that is particularly adapted to reveal the

[17] Of course Dewey is formulating a humanly embodied 'continuity of inquiry' in the context of modern experimental and mathematical science, neither of which mark Aristotelian science. Nonetheless, Aristotle's science was the first to establish specialized science that was rigorously empirical in ways that exceeded what the mathematics of his day was able to achieve, and he did this by creating scientific concepts and procedures for transforming the whole of Being into separable subject matters as different sciences. In that sense Aristotle was in fact the first person to establish a "continuity of inquiry" beyond that of common sense reasonings. He certainly had to reconfigure and respecify his metascientific concepts and methods for the development of each specialized science.

Whatever ancient versus modern differences apply, Aristotle's philosophy of nature is scientific in its specialized determination of different "natures" within the whole of Being. In effect, Dewey's logic brings the experiential integrity of a modern scientist's practices and transformations in their specialized existential engagements with scientific problems back into the foreground as an intrinsically teleological character of inquiry (1938, p. 462). Such a teleological principle was present in and throughout Aristotle's science but has been lost sight of in today's science even as it is aggressively pursued in guiding specialized research but as yet in generally unintegrated and unregulated ways especially with regard to common sense inquiry.

empirical samenesses and differences *among and then within the poetic species* that are presented in the actual things. Thus, such organizations of phenomena are knowledge practices or <u>epistemic procedures</u> that capture the structure and function of the observable phenomena as primary in their qualitative and enumerative appearances. It is in this sense that I will use the term '*arithmoi* of phenomena.'[18] A working definition of the technical term could then be given as:

> '*Arithmoi* of Phenomena' are non-mathematical conceptual unifications developed under empirical scientific procedures or techniques for the transformation of qualitative presentations into phenomenally grounded scientific knowledge. (They are non-mathematical because mathematical idealizations, such as the definition of triangle, are <u>separable from perceptual experience</u>.) Such *arithmoi* of phenomena are unifications of "the one with the many" under a scientific theory such as genus/species as the relationship between poetics-itself and its species themselves; a second instance is the determination of a subset or basis set of species as adequate to represent the phenomenal qualities of the larger whole of poetic variation found in the six species of Greek sentence 2 as sufficient to identify the different capacities of the poet; another is the unity of tragic plot as architectonic for all six parts of tragedy in chapter 6. These unifications of scientific concepts with scientific methods as determined in argued discourse work to reveal the deeper, more stable properties generating the phenomena *and* to disclose the invariant forms or structures within phenomenal variations. All of them are developed for

[18] Consider this an instance of Aristotle's empirical advance over the Pythagoreans. Klein gives an insightful basis for such a step in Aristotle's understanding of their use of *arithmos*:

> "The general point of view governing the efforts of the Pythagoreans might be sketched out as follows: They saw the true grounds of the things in this world in their countableness, inasmuch as the condition of being a "world" is primarily determined by the presence of an "*ordered arrangement*" — and this means a *well-ordered arrangement* — while any order, in turn, rests on the fact that *the things ordered are delimited with respect to one another and so become countable*. Aristotle, who accuses their "definitions" of superficiality, states the fundamental principle of their procedure with complete clarity: 'That to which [in the order of things] the term in question primarily belongs, this they consider to be the being of the thing.' *Metaphysics* A 5, 987 a 22 ff. 71 But, in accordance with Aristotle's statement, which is valid for all of Greek cosmology, *"the order proper to the objects of sense [i.e., the order of the visible world] is nature*" — *On the Heavens* Γ 2, 301 a 5 f.; see also *Metaphysics* Λ 10, 1075 a 11– 23); in other words, this order determines the very being of things, and, furthermore, this order rests in the final analysis on the possibility of distinguishing things, i.e., of counting them." (Klein 1968, p. 64ff. Italics mine.)

> the purposes of higher order conceptualizations that give us a more knowledgeable access to the selfsame phenomena of the subject matter in an organized whole of situated inquiry. They are marked by a regulative scientific purposiveness.[19]

In relation to this working definition, a key example of what I mean by '*arithmoi* of phenomena' in Aristotle's philosophy is his differentiation in *Poetics* 1-5 of various species of art via the system of the four causes as they variously co-function in works of art. This example illustrates Aristotle's method of species differentiation as unifying many species into one quasi-genus of "poetics-itself" to be an *arithmos* that organizes the complex of actual phenomena presenting a multiplicity of aspects. Admittedly, '*arithmos* of phenomena' is a hybrid technical term. In order to heuristically reconceptualize 'ordering relationships' within Aristotle's discourse, this term disengages from our modern strict sense of "number" as formally sufficient.

[19] This concept is intimately related to what Christopher DiTeresi (2010) has named the 'pragmatics of sameness' exemplified in procedures for the developmental typing for zebra fish:

> "There are in fact two well-known *practical identities* couched in the reproducibility of experiment - one procedural, and the other phenomenal. On the one hand one must be able to do the same thing again, or follow the same procedure. On the other hand, doing so must generate the same result. That is, following the same procedure must generate the same phenomenon. The intimate link between procedure and phenomenon has been a major focus of historians and philosophers of science who study experiment. This link is captured in the notion of *experimental systems as complex procedural and material arrangements that are required to generate and to stabilize phenomena for experimental investigation*. Experimental systems are designed around meeting the *practical constraint of reproducing the same phenomenon*." (p. 80. Italics mine.)

Aristotle's pre-experimental science is constituted through a rigorously reflexive use of such scientific *arithmoi* in that he "saves" the phenomenon, or "keeps it the same," by reproducing it in increasingly central and higher order conceptualizations of the selfsame phenomenon. He does this by returning to it recurrently until he achieves a stable form "essential" to the substance itself in relation to the 'primary facts' of the phenomena. For a computational approach to modeling and analogy-making instantiations that are closely related but not identical, see Robert M. French, *The Subtlety of Sameness*. MIT press, 1995. French makes use of a computer program, Tabletop, that generates representations open to our perceptions of sameness, and thereby discloses conceptual accidences in the microworld of laying out "everyday objects on a table set for a meal."

For example, it disengages us from the number line that we routinely project back to a time without access to Arabic numbers and without our positional notation of expressing numbers as constituted by orders of the powers of 10 in such a way as to facilitate our calculating according to arithmetic algorithms especially for multiplication and division. The ancient Greek system was an "additive" math in which various powers of ten were signified by letters and then the "letters" were added up. This additive system is much less rigorous than our self-grounded mathematical formalisms. While multiplication was known in classical Greece, it was a real intellectual challenge, one that we can recover by thinking of doing math in Roman Numerals, which were an adaptation from the Greeks who tended to assign the initial counting numbers to the letters of the Greek alphabet.[20] At that time, the numerological term "*tetractys*"[21] was

[20] Only after Aristotle, in Archimedes' (c. 287 BC – c. 212 BC) letter *The Sand Reckoner,* did "large finite" take on conceptual determinacy. In the section on "Orders and periods of numbers," Archimedes began to more adequately conceptualize large finite numbers into numbers of different "orders," such as when the myriad (10,000), which had this traditional name, is extended to a "myriad myriads" (100,000,000); and identified all these numbers up to 10^8 as numbers of the "first order." Using a line of thought rather similar to Kant's expansion of measures in the mathematical sublime, Archimedes then conceived of a "second order" for numbers from 10^8 to 10^{16}. He then carried such "orderings" up to (10^8) raised to the power10^{16}. This understanding certainly goes far beyond the implicit "16" of Aristotle's causal differentiations. See URL: https://web.archive.org/web/20040808005307/http://www.calstatela.edu/faculty/hmendel/Ancient%20Mathematics/Archimedes/SandReckoner/SandReckoner.html (accessed 04/15/18)

[21] The "*tetractys*" was a core Pythagorean symbol with political, philosophical, and religious as well as mathematical significance:

> The symbol on which the members of the Pythagorean community swore their oaths was the *tetractys*, or holy fourfoldness, which was supposed to stand for the four elements: fire, water, air, earth. The *tetractys* was represented geometrically by an equilateral triangle made up of ten dots, and arithmetically by the number 1 + 2 + 3 + 4 = 10. According to the Greek writer and satirist Lucian (120-180), Pythagoras asked someone to count; when he had reached 4, Pythagoras interrupted, "Do you see? What you take to be 4 is 10, a perfect triangle and our oath." … Like other mystery cults of that time, the Pythagoreans had their strange initiations, rites, and prohibitions. … They further theorized that everything, physical and spiritual, had been assigned its allotted number and form, the general thesis being "Everything is number." … The Pythagorean doctrine was apparently a curious mixture of cosmic philosophy and number mysticism, a

commonly received as a high-level ordering concept for both arithmetic *and* nature; it was espoused by the Pythagoreans and then further idealized by Plato into "forms" that we participate in on the Divided Line that is inclusive of mathematical reasoning.

To me, Aristotle's methodological development of '*arithmoi* of phenomena' presents the plausible possibility that his achievement of rigorous empirical sciences takes the mythic and ideational uses of numerology such as the Pythagoreans' reverence for the number four of the *Tetractys*[22], and then transforms it to an <u>observational procedure for phenomenological rigor</u> in scientific research and exposition. How, then, did Aristotle's philosophy push the tradition to a

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> sort of supernumerology that assigned to everything material or spiritual a definite integer. …, we find that 1 represented reason, for reason could produce only one consistent body of truths; 2 stood for man and 3 for woman; 4 was the Pythagorean symbol for justice, since it was the first number to be the product of equals, … and so forth." (Burton 1991, p. 92-4.)

See also Heath 1921, ch. 3, "Pythagorean Arithmetic," pp. 65ff, and Arist. *Metaph*. A. 5, 985 b 23ff. For a flavor of the mysticism or numerological mindset this carries to our times, see: "Tetractys" URL: <u>https://en.wikipedia.org/wiki/Tetractys#Pythagorean_symbol</u>, Wikipedia.

[22] It is generally recognized that Plato was strongly influenced by the Pythagoreans, and that the association of cause with number was part of the tradition. Hankinson (1998) makes such connections in his section on Pythagoreanism relatively recently. Moreover, scholarly treatments going back to at least 1881 do so as well. For example, in part III of a series on "The Development of Religion in Europe" the author presents a set of linkages between the tetractys, Plato, and Aristotle:

> "The trinity [of gods] of Plato will be better understood by examining the form which it took in the doctrines of his disciple Aristotle. *A trinity with matter added makes a tetractys*. Aristotle therefore, after laying down that the first causes of all things are gods, goes on to say that there are four kinds of causes, that is to say: Essence, or "the what," usually translated the formal cause; matter or substance, usually translated the material cause; the origin of motion, usually translated the efficient cause; "the for the sake of which," or *Tagathon*, usually translated the final cause – in which doctrine one may see the following scheme of the universe. … It must be noticed that the faith of Aristotle is less than that of Plato; he did not suppose his essences to exist apart from the matter on which they were impressed." (THE DEVELOPMENT OF RELIGION IN EUROPE. AMICALIS. *The Melbourne Review* (Melbourne, Australia), [Friday], [April 01, 1881]; pg. 130; Issue 22. Empire.)

greater scientific rigor that better recognized the natures of different kinds of things without use of abstract math? An advance that put empirical science on its first firm basis?

Two Aristotelian advances required to establish empirical science

To develop an '*arithmoi* of phenomena', two primary scientific advances are required: developing a functionally coherent system of four kinds of causation as appropriate to a single substance, and finding ways to increase phenomenal specificity. First, the unity ascribed to the *tetractys* and carried forward by Plato's ideas must be transformed from mathematical or strictly 'formal' ideas above mathematical reasoning on the Divided Line and also separable from the material particulars of things[23] into an empiricism of the features of nature (*phusis*). His review of former philosophers in the *Metaphysics* led him to discovering four rather than three, two, or one kind(s) of causation, and he appears to have assimilated this to the wider cultural engagement with the *Tetractys* with its relation to the Decad. In a powerful move, Aristotle takes the very property of Greek numeracy, namely that an *arithmos* must remain tied to the things it counts, and finds a deeper, phenomenally concrete, grounding for conceptualization through an *arithmos* of four kinds of causation. Each causal category of phenomenal aspects retains its referential links to actual things that is both adequate and sufficient for disclosing the inner constitution of a thing according to that category. Taken together as a separation in thought that nonetheless maintains the unity of all the aspects in a single substance, the methodical application of the conceptual system of causes grounds the new empirical science of phenomena by allowing the bringing forth or presentation of those aspects in an orderly yet coincident manner. This first advance provides an empirical power of reference not found in Plato's ideas,

[23] See "Origin of Plato's views" in W. D. Ross, *Aristotle's Metaphysics – Volume 1*. Cambridge: Oxford University Press, 1924, pp. xlv to lxxi.

which idealize separable essences, nor in Pythagorean numerology. The second advancing move was to take the abstract contraries of his predecessors that sought generality or universality in the contrary itself with such indeterminate theoretical pairings as the Pythagorean Table of Ten Principles,[24] by substituting *phenomenally contentful contraries* such as [visual | aural], [noble | base], and [dramatic | narrative] that are <u>particular to a given natural substance</u>, for the more general or abstract ones of the Pythagorean Table of Ten or the Decad. Hence, in the first advance, Aristotle ties the systematic conceptual unification of *arithmos* to <u>observation of causes at work in phenomena</u>, and second, he <u>ties observation to specialized content contraries for a single kind of thing</u>. His contrary measures are tied to specifics of the phenomena. These two advances give us a relatively fixed notion of an *'arithmos* of phenomena' as a unified way of indicating the nature of a substance. [25, 26]

In addition to Aristotle's development of a causal system and contentful contraries, a similar story could accompany Aristotle's use of an <u>explicit</u> listing of a group of six phenomenally comprehensive species of poetry to capture the full range of possible species. This group actually embodies the full phenomenal range required for a combinatoric comparison and contrast of all the given species including the remaining ones not explicitly mentioned. Another use of an *arithmos* as a function of phenomena is the listing of "six" (*hex*, ἕξ. 1450a9)

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[24] In Aristotle's account the ten are: "limit and unlimited, odd and even, one and plurality, right and left, male and female, resting and moving, straight and curved, light and darkness, good and bad, square and oblong" (*Met. i.* 5, 986a23-986b1ff.)

[25] There is also a dynamic side arising from the combinatoric relation of the Tetractys to the Decad that I will pick up again towards the end of the next heading after some formal structure can be recovered for the causal complex. (See following footnote.)

[26] The Decad consists of the first four numbers: 1, 2, 3, and 4, taken together add up to 10 = 1 + 2 + 3 + 4 giving us the Decad out of the formation of the Tetractys by units: 1 + 1 + 1 + 1 = 4. This operation gives a "combinatoric enlargement," not quite straight multiplication but more expansive than simple successive addition.

functionally interacting parts of a Tragedy which can again be traced back to their causal origins, as Aristotle does. Both of these uses are "phenomenally adequate" in new ways because each grouping of six *presents* an "adequate" basis for observing all the primary factors either for poetics as a whole, or for the more specialized causes respectively at work in Tragedy as a single whole species.

My assertion is that Aristotle's science shifts from the then culturally prevalent numerology of the *tetractys* to a systematically empirical science of causation as well as other unified functional organizations of phenomena. Aristotle's *Metaphysics* gives a statement of this shift:

> "And this is reasonable; for the One means the measure of some plurality, and number (*arithmós,* ἀριθμός) means a measured plurality and a plurality of measures." (*Met. XIV (N),* 1, 1088a4-6. See also 1087b33-1088a14, and surrounding arguments.)

Accordingly, "*arithmoi* of phenomena" is a hybrid term for numeracy in Aristotelian science where phenomena have a conceptually integrated numerical and qualitative character (e.g., *póswn kaì poíwn*, Poet. 1. 1447a12). The term helps to afford us a better understanding of how Aristotle's philosophy pushed his tradition to a greater scientific rigor that better recognized the natures of different kinds of things. In that way, this hybrid term has the potential for re-engaging with our current fully mathematized sciences by having the power to point out a rigorous mode of empirical accuracy that conceptually "saves the appearances" as they are actually encountered in experience in ways no longer envisioned as possible. A point to keep in mind is that a dismissive critique of this ancient mode of numeracy that depends upon modern mathematical or logical precision would be anachronistic.[27]

[27] An artistic recognition of this fact can be found in Thomas Mann's opening to his *Joseph and His Brothers* novel with a prelude, "Descent into Hell," that provides a similar

<u>Aristotle adapts and applies such conceptually and methodologically unified *arithmoi* throughout his sciences</u>

There are other cases of '*arithmoi* of phenomena' in Aristotle's treatises. One of the features noticed by most readers of Aristotle is the fact that certain numbers occur repeatedly. As noted, the most prominent is the foursome system of causation which can be found in numerous places in the corpus. Another numerical feature that is very evident in the *Poetics* concerns the concrete references provided under the *arithmos* such as the number six that provide order for functionally related things. As indicated above, Aristotle instances two such orderings: the six poetic species (sentence 2), and the six parts of a tragedy (ch. 6). For example, the list of five kinds of truth that organizes the intellectual virtues in Book vi of the N. Ethics: art (*techné*), scientific knowledge (*epistēmē*), practical wisdom (*phrónēsis*), philosophic wisdom (*nous*), and intuitive reason (*sophia*).[28] This list gives us a much more robust notion of where the reasoned capacities embodied by each of these modes of knowing can be taken with each and every one

reconceptualization for the benefit of moderns. The prelude performs a literary version of re-contextualizing our later understanding of an earlier age through a novelistic presentation of how Joseph's context could successfully scaffold his interpretation of Pharaoh's dreams of numbers of kine and corn from Genesis 41 (*Joseph the Provider*, p. 1128ff.). It turns out that through Joseph's hermeneutics, Pharaoh was having a pretty good insight into political economy that we still recognize today: in a time of wealth plan for a future of poverty. That is, seven fat cows or heavy corn harvests have to be balanced out by expecting 7 lean cows or little corn. It would also be beside the point to apply modern math forms to ancient numeracy because Pharaoh's numbers were ordering phenomena that are richer in diversity than modern mathematics finds room for. Again, Pharaoh could just as well have dreamt of eight fat and lean cows, as dreaming of seven, and still Joseph could have had a correct interpretation about planning for famine. (See footnote 23.) Today we know that "7 plus or minus 2" (Miller 1956) is a typical number for humans to be able to remember, so it might not have been entirely accidental that Pharaoh might have arrived at that cognitive coincidence. Indeed, it makes a better story to have it be 7 because of the number's consonance with a generic human power of memory, as both the Bible and Thomas Mann's retelling captures that power in its art.

[28] My deep appreciation goes to Herman Sinaiko for pointing this out and helping me understand it.

giving indications of where "truth (*aletheia*) by way of affirmation or denial" is at work. (*N. Ethics vi.* 3, 1139b14ff.)

Yet his *Metaphysics* clearly states that numbers per se and mathematical objects do not exist ontologically prior in the sense of being the principles or origins of the things that constitute physically real things. (*Met. Bk. XIII (M),* 10.). Hence whatever such numbers as four, or five, or six do in expounding a science, their contribution is not made as mathematically separate objects without reference to phenomena per se that give us the system of four causes, the five virtues of knowing or the six parts of tragedy. For Aristotle, the phenomena must be referred to: "If the sensible things are divided the others [mathematical objects] will be divided too, or else not even the sensible things can be divided." (*Met.* 10.2 1076b38). Nor do the numbers or mathematical objects exist prior to physical things:

> It has, then, been sufficiently pointed out that the *objects of mathematics are not substances in a higher sense than bodies are*, and that *they are not prior to sensibles in being*, but only in formula, and that they cannot in any way exist separately. But since they could not exist in sensibles either, it is plain that they either do not exist at all or exist in a special way and therefore do not exist without qualification. For 'exist' has many senses. (*Met.* 10.2 1077b17ff).
>
> (3) Just as the universal part of mathematics deals not with objects which exist separately, apart from magnitudes and from numbers, but with magnitudes and numbers, not however qua such as to have magnitude or to be divisible, clearly it is possible that there should also be both formulae and demonstrations about sensible magnitudes, not however qua sensible but *qua possessed of certain definite qualities*. (10.3 1077b30ff. Italics mine.).

Moreover, Aristotle transforms the problems of Platonic "eidetic" numbers with their inability to "count" fundamental kinds such as Being, Motion, and Rest[29] into a clearly empirical ordering through the concept of substance.

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[29] For Hopkins in the context of the "… mysteriousness of numbers and their status as the 'model' for the 'structure' of the logos" (p. 151) in Plato's *Theaetetus*, and "… because the logos wants to count 'three' where there is, in truth, only two, the number in question is eidetic, not

> Since, therefore, while there are numbers and a one both in affections and in qualities and in quantities and in movement, in all cases the number is a number of particular things and the one is one something, and its substance (oùsía) is not just to be one, the same must be true of substances also; for it is true of all cases alike.
>
> That the one, then, in every class [genus] is a definite thing [certain nature], and in no case is its nature this, unity [itself - the one] is evident; but as in colours the one-itself which we must seek in one colour, so too in substance the one-itself is one substance. (*Met*. X.2.1054a5-13. Ross trans.)

With these qualifications about numbers and mathematical objects in mind, we are constrained to think either that "four" causes or "six" parts are so "numbered" on the strictly empirical basis in which they have no scientific organizing power beyond that of combinatorically grouping phenomenal observations brought to order as instances of their own qualifications, *or* that such numbers indicate some conceptual result of the systematic investigation of the substance or phenomena in question as artifacts of the methods.

This conceptual development brings numeracy into the empirical phenomena of a single substance. It allows the phenomena to be particular qualities in relation not to number-itself but to the unity and coherence of a substance or nature as indicated through a combinatoric grasp of their functional interrelationships. This development makes for an advance from Platonic logos to an empirically scientific logos. For example, when coupled with Aristotle's system of four causes, it allows the codification of his researches into what are the primary factors in substances (such as given in book I of the *Metaphysics*, and elsewhere), where he critiques earlier philosophical searches for the principles of things that relied on selecting one of the four material

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mathematical. Precisely the inability of thought to count the *gene* of Being, Motion, and Rest defines the failure of the logos. This inability is manifest in the fact that in order to give an 'account' of these *gene*, thought cannot help but count each *genos* as one, and therefore, as a discrete *genos*, whereas the consideration of the nature of Being in relation to Motion and Rest cannot help but to conclude something very different, to wit: that the *genos* of Being is not discrete from these *gene*, but rather encompasses them in a manner that unifies them without the basis of that unity being something in common among the incomparable "units" that are unified." (Hopkins 2008, p. 151, 154) elements – such as water – as primary to all, or on "contrary" divisions such as Empedocles' positing friendship versus strife, or Democritus' positing the full and the empty as origins for all things. He further critiqued the Pythagorean reliance on number itself which gives principles for nature and its phenomena (*Met. I,* 8, 989b30 - 990a31) and a table of ten contraries as the Decad that arises from the *Tetractys* (*Met. A* 5, 985b23-986ab31). In fact, Aristotle goes on at length in his critical analysis of the previous wise thinkers in order to determine *four kinds* of primary causation as more comprehensive and more systematic than his predecessors, and proceeds to integrate these conceptually distinguishable origins into a functional system of causation captured in phenomenal presentations.

The organization of this system springs at least in part from Aristotle's theory that any actual thing will consist of and present all four of these kinds of primary causation as occurring together by nature according to the essential characters of each of the different kinds of things in themselves. Aristotle's system then is intrinsically functional at a general or "meta scientific" level that can be adapted to each special kind of thing as substance. And it is indeed the different kinds of substantive constitution that he seeks to disclose in his sciences, each with its specific causes and relations in the actual objects of one science, and as varying between sciences. For example, the causes discussed in *De Anima ii.* 1-5 have different phenomena for material (organized body), formal (life-form/1st actuality), efficient (life powers and motions), and final (objects aimed at, and activities by which) causation that are quite different from those of poetics. When it comes to poetic science, the causal system is adapted to the quasi-essential substance of poetic artifacts or "poems" that are dependent on the human nature of perception, knowledge, and experience.

<u>What is the epistemological status of the System of Four Causes in the *Poetics*?</u>

What then is the proper epistemological status of this system of four causes? It is certainly not strictly mathematical, nor simply an imposition of scales of quantitative measure on the things. What I propose is to recover what such a causal system does and amounts to *strictly in textual terms* as it develops procedurally in the *Poetics* under the technique of differentiation. I will be leaving aside the vast academic discussion of his causes at least until we can point to how he puts the causal system to work in differentiating the species of poetry. Each science has its own proper contraries that designate the specialized phenomenal content for the given science: for example, for poetry: [visual | aural] - material, [noble | base] - formal, and [dramatic | narrative] – efficient. Final causation has its focus on the whole of poetics from the standpoint of human universals rather than the poet's art so its contrary is [learning | delight] with a basis in our shared capacity for enjoying rhythm.

The results of the exegesis are such that some mode of numeracy definitely plays a role when, for example, Aristotle makes a distinction between Dithyramb as combining all three material means of rhythm, speech, and harmony in the singing and dancing of a sacred hymn, whereas in Greek tragedy these same three means are treated as separate elements brought in at different points (1. 1447b28). This difference surfaces how for Comedy and Tragedy their separate phenomenal presentations are more clearly discernable as the material phenomena of rhythms, speech, and harmony are themselves poetically arranged for a separable dramatization in different segments that enhances their contributions to a more cultivated poetic experience. But there are also natural constitutive contraries for people such as the formal contrary between noble versus base actions (ch. 2) that are imitated, and the efficient contrary of narrative versus dramatic styles of the poets (ch. 3). These contraries are grounded in phenomenal content, rather than posited theoretically. Moreover, there are the human universals of *learning* through and *delighting* in imitations that engage with the workings of the human soul while spectating in pleasurable functioning (ch. 4). The crucial point, which is to be given as evidence in the text itself, is that it is the reciprocal and cross-functioning of the causes as given in the actual things and categorized under system-specific contrary filters or qualitative measures that gives rise to and determines the essential features of that sort of thing as a single genus differentiable into its natural or artificial kinds.

Explicit Statement of Four Project Purposes

In my exegesis of *Poetics* 1-6 according to the above sequence (i-iv) of scientific procedures "on the whole" (see p. 47, above), my project has *three primarily interpretive purposes or goals*, which are described more fully in the rest of this Scene: first, to reconceive and reenact the argument of the science as it develops; second, to determine the particular scientific terms and methods used as they develop in sequence; and third, to elucidate Aristotle's model of poetic species differentiation that is constitutive of poetics-itself as the subject matter of a productive science.

Achieving those three interpretive goals will provide the basis for determining the specialized concept of "essence" at work in Aristotle's science of the quasi-genus[30] of poetics-

[30] In Aristotle's science only *natural things* can be a true *substance* with a fixed *essence* as distinct from artificial or made things. This distinction generally renders the idea of a "genus/species" relationship as strictly tied to something with a "nature" (*phusis*). And yet he implicitly invokes that very relationship as grounding his method of differentiation when he identifies the two respective terms for poetics: poetics-itself (*poiêtikês aùtês*) and its species-themselves (*eìdôn aùtês*) in Greek sentence 1. Poems do not have "natures" in the same way as living and other kinds of natural objects, so it would be more precise to refer to 'poetics-itself' as a "*quasi-genus*." And yet, he recognizes art as a means of completing nature, rather than fully separate from it (*Met. ii*. 8, 199a9-b8). Moreover, since he invokes the distinction and uses it analogically, I will simply use the terms "genus" and "species" without tediously repeating the difference, especially since it is not often of great relevance.

itself. Simply stated, Aristotle's *essence of imitative making* is one of *concretely contextualized poetic artifice*: a 'productive *and* performative essence' that realizes the proper form of a cathartic play through the poet's synthesis of such a form in her city and as idealized in the *Poetics*. The proper form is idealized in the sense that the *Poetics* presents "how stories should be put together if the *poiêsis* is to be beautiful/noble (*kalos*)[31]" (1447a9-10. Bendardete/Davis trans.).

The above trifold determination of Aristotle's science then allows a fourth, modernist, goal to emerge: namely, to *carry* this discursively extended sense of poetic essence *forward* into our contemporary context of productive sciences, especially as conditioned by the higher-order formal numeracy best realized in concrete experience by computational devices. This latter neoteric goal can only be provisionally approached here in ways akin to what Dewey would have called new problem determination in the pursuit of fresh "pattern(s) of inquiry" (Dewey 1938, ch. 6). In our globalized context of the problems intrinsic to living with the extensive pluralities of culture with all their conflicts, difficulties, and potential goods, it seems only prudent to make the attempt, even if at times it would require a longer discussion, i.e., a true "second sailing" (Plato, *Phaedo* 99a6-100b3, Benardete 1989), for a satisfying resolution. This fourth goal is the subject of Scene II, while the first three goals are discussed in this Scene, as follows.

«First Interpretive Goal: *To reenact the argument and reconceptualize Aristotle's scientific concepts*»

[31] Benardete/Davis have a footnote on the Greek word *kalos* that allows for the double meaning of "beautiful/noble" given here: "The Greek word here is *kalos.* In its adjectival form, *kalon,* it means both beautiful and noble. We will translate it by both; sometimes together, sometimes, where the context demands, we will choose one or the other." (p. 2, footnote 4.)

The first goal is both to "reenact" (Collingwood 1946, 1939; Felson and Parmentier 2015) Aristotle's foundational argument, rather than comment on or abstract epitomes of insight from it, and simultaneously to *explicitly* formulate multiple heuristic conceptual schemes (Wimsatt 2007, chs. 2, 5, 6, App. A & B) which together "model" or "reconceptualize" the particular scientific framework that Aristotle *implicitly* employs in his productive (and highly enthymematic) discourse on poetics.

«Second Interpretive Goal: *To determine the specialized scientific tasks of the* Poetics »

The second interpretive goal is to treat the text as an extended argumentative *discourse* rather than a series of atomically abstracted logical propositions. The point of taking this 'long view' – which includes all the natural language expressions of the text as multiply significant – is to explicitly approach the entire discourse of the *Poetics* as a specialized scientific treatise that is a coherent argumentative whole in which all the linguistic parts influence and shape the significance of each other (McKeon 1946, 1966). The exegesis will exhibit that this discursive whole is composed of a sequence of conceptually separable stages of scientific inquiry as indicated above, each of which has its own appropriate scientific technique or method for its specialized task in progressively developing the subject matter of poetics as it is constitutive of the productive science.

For this project's limited portion of the treatise in view (chapters 1-6), three focal sections of the text develop the productive science of poetics in a sequence of techniques or methods, outlined below as Technical Focus I, Technical Focus II, and Technical Focus III.

Technical Focus I (stage 1): Greek sentences 1 & 2, respectively, posit the theoretical principles and phenomenal origins of poetics-itself (*poiêtikês ȧutês*) and its species-themselves (*eἰdôn ȧutês*) as concretely emergent in the city. Greek sentences 1 & 2 will be presented as an exemplary case of *productive ambiguity in discourse* made possible by 'heuristic reconceptualization' later in Scene III.[32]

Technical Focus II (stages 2 and 3): Chapters 1-5 conduct the systematic causal (*aitia*) differentiation and evaluation of the species phenomena of imitative making, while also disclosing in chapters 4 and 5 that: "Some two causes, and these natural, are likely to have generated poetics as a whole."[33] These two causes (*aitiai*) or "first things" are that we learn at first through imitation (*mimêsis*), and that we all delight in works of imitation. They provide the phenomenal facts of human nature which complete the system of causal differentiation (initiated in Greek sentence 2 and completed in chapters 4 &5) as the particular origins for the final causality of imitative making, as made manifest in the histories of the three most important species of tragedy, epic, and comedy. In this section Aristotle completes his species differentiation according to the system of the four causes. Chapters 4 & 5 provide the crucial final causality or "telic turn" (*periagōgē*) required for catharsis to a narrowed range of more significant phenomena restricted to those three species that are sufficiently developed, primarily through their sophisticated use of natural language, so as to make them capable of higher conceptual formulation in a productive science. Technical Focus II will again be picked up and elaborated in the discussion of my third interpretive goal of formalizing Aristotle's Discursive Model of Species Differentiation.

Technical Focus III (stage 4): Chapter 6. This stage of poetic science is composed of three closely related scientific tasks taken together within a very small discursive extent: 4a)

[32] This focus is presented as exemplary of 'heuristic reconceptualization' and 'procedural reenactment' in Scene III.

[33] 4. 1448b4-5. Benardete/Davis translation of "ἐοίκασι δὲ γεννῆσαι μὲν ὅλως τὴν ποιητικὴν αἰτίαι δύο τινὲς καὶ αὗται φυσικαί."

Definition, 4b) Analysis of a whole into parts, and 4c) the Constitution of a functional whole of tragic parts governed by the architectonic part of Plot. In stage 4a, the text quickly collects just those primary phenomena that together function causally for just one species-itself, viz. Tragedy, and reformulates them into a scientific definition of Tragedy as a species whole. In stage 4b, with an amazing turnaround, Aristotle's argument then grasps these specialized species phenomena through an articulation of their complex of functions within the array of existing tragedies by organizing them into a system of six co-functioning parts: plot, characters, diction, thought, spectacle, and melody. Explicitly keeping track of each part's causal origins, Aristotle then lays them out a second time through specific claims about the primacy of plot. Doing this now orders these parts, in stage 4c, according to their worth and contribution to a tragic synthesis with plot or story of first importance, since its action provides "the end (*telos*) and purpose of the tragedy" (Bywater). Character comes second, thought third, and then diction, melody, and finally spectacle. Within this ranking, Aristotle simultaneously connects poetics to the science of biology (*De Anima*) with a basic scientific analogy[34] between the first actuality of a living thing – its soul or life-form – and the first actuality of a tragedy – its plot. This discursive simultaneity allows and produces a higher order offspring within the plot: its greater formal intricacy of imitation through the "most powerful elements of attraction in Tragedy, the Peripeties and Discoveries, [which are] parts of the plot" (6. 1450a33-35). By the end of chapter 6, Aristotle has fully grasped the necessary phenomenal ordering so as to carry that forward into the fifth

[34] A "scientific analogy" provides structure and function across the domains; a mere "metaphor" would only create "an interesting connection."

scientific task of discursively enabling a poet's engaging her own processes of artistic synthesis with those of the idealized and generalized species of Tragedy-itself.

For this exegesis, chapter 6 is my exemplary case of doing a 'procedural reenactment'. Chapter 6 productively leads the poet's process of making by reformulating the most noble of the city's imitative species phenomena, 'Tragedy'. This reformulation is accomplished by Aristotle's application of three coordinated scientific techniques. The first technique reformulates or "begins again" with greater insight into tragic substance by laying out a *quasi-essential definition* of Tragedy as a species:

> A tragedy, then, is the imitation of an action that is serious and also, as having magnitude, complete in itself; in language with pleasurable accessories, each kind brought in separately in the parts of the work; in a dramatic, not in a narrative form; with incidents arousing pity and fear, wherewith to accomplish its catharsis of such emotions. Here by 'language with pleasurable accessories' I mean that with rhythm and harmony or song superadded; and by 'the kinds separately' I mean that some portions are worked out with verse only, and others in turn with song. (6. 1449b4-28. Bywater.)

The point to take seriously here is that the scientific definition is constituted by precisely those phenomenal aspects (1449b4-28) that are the ones more essential to tragedy out of all aspects disclosed. This definition is not determined by some abstract categorization. While these essential aspects are differentia disclosed by the preceding speciation technique, what is <u>not</u> important about this is the fact of being differentia per se in form. Rather what <u>is</u> important is that applying the method of differentiating has disclosed the phenomenal closeness of these aspects to the primary (*tõn proton*) causation for *this singular* species within the whole of poetics-itself, viz. the actual aspects of an actual play as given according to the four causes proper to poetic science – means, object, manner, and cathartic function – rather than some other subject matter.

Aristotle's scientific definition of Tragedy moves the scope of poetics from Poetics-itself to the specialized scope of Tragedy-itself. The whole of poetics is now viewed as it functions within Tragedy as a sub-whole. The particularity of the primary causes develops according to this shift. For example, the focus shifts from the whole formal contrary of [base character | "as we are" character" | noble character] to the more specialized phenomenal features of "imitation of an action that is serious and also, as having magnitude, complete in itself." Moreover, these aspects are observable properties-as-phenomena for a *particular tragedy* that stand for themselves, such as the catharsis of Oedipus dashing out his eyes for not seeing himself as the origin of the pollution in Thebes. The causal aspects constituting the definition <u>are tied</u> to the phenomena. As spectators we apprehend them as such. The more specific causal aspects *are* the phenomena as they function in Tragedy, not abstract names for the content of the properties suitable for abstract manipulations. Again, from the example, the causal aspects of Tragedy collected by the definition signify in an *arithmos* or number-like fashion to definite appearances of things in the world. The method of differentiation makes the reorganization of phenomenal aspects into the combinations for each species feasible while emphasizing them as phenomena, not as a theoretical construct intended for reduction to conceptual simples. This completes Task One.

An '*arithmos*' mode of signification is carried forward and conceptually intensified in the two techniques following differentiation: scientific definition of a species, and the analysis of its parts. Aristotle's science gets increasingly closer to the origins of actual phenomena by developing more specialized scientific terms that capture increasingly central phenomenal aspects. Accordingly, definition is followed by the second technique of *analyzing the species-itself* of tragedy into the constitutive whole of six co-functional parts: spectacle (efficient);

melody and diction (material); and action as plot, thought and character (formal) (6. 1449b31-1450a14). Then by applying a third technique of *further determining the functional relationships between the parts*, Aristotle takes advantage of the fact that three of these parts – plot, character, and thought – arise from formal causation to establish the dominance of plot and the possibility for a higher-order conceptualization for tragic catharsis. This completes Task Two.

With the results of these two tasks in hand in the first half of chapter 6, Aristotle proceeds *once again* by reformulating the causal origins and essential definition of tragic effects with an even greater phenomenal intricacy for the substance of tragedy. He does this by conceptualizing 'plot' at an even more formal level beyond that of Tragedy as a species-itself. 'Plot' is transformed from being a constitutive part of Tragedy into becoming <u>the one part</u> that is fully coincident with Tragedy; it becomes the organizing function for Tragedy. This transformation is accomplished by explicitly arguing that 'plot' is the "life-form" or soul (*psuché*) and thereby analogous to a biological life-form as a *poetic first actuality* (*entelécheia*). Accordingly, a tragic plot is produced by the artist's synthesis and performed by the actors' presentations of the actions of a particular play, and ultimately through both the poet's synthesis and the actors' performance, the plot imitatively "lives" the agency of the catharsis for the audience as the activity of a second actuality. For noble and beautiful (*kalos*) plays, these activities realize the poetic causality of plot's *second-order formal conjunction* with *character* and *thought* into the new coincident unity of the life-form of Tragedy within the first-order formalization of Tragedy-itself. This conjunction is productive of the higher-intensity cathartic unification of pity and fear into a tragically satisfying resolution of the tragedy's conflicts into their proper ends. The unification conceptually merges the poet's use of the formal causation of imitating serious agents acting with her use of the final causation of imitating tragic conflict resolution into the completing activities (*energeia*) of the plot's reversals (qua character) and discoveries (qua thought) now intrinsic to the plot-life-form as cathartic for the audience's unreached telic ends. This completes scientific Task Three.

The nobility of tragedy as the best and most important species

An interesting difference between poetics-itself as a whole and Tragedy-itself as a whole is that the various species of imitation are separable from each other in a different way than the ways the parts of a Tragedy are. For example, Comedy and Tragedy are separable species because while they use the same means and manner of imitation they have different objects, i.e., base vs. noble, and different catharses, ridiculous vs. pity and fear. Thus they present different phenomenal wholes. By contrast, the parts of a Tragedy are fully coincident with Tragedy-itself and actual individual tragedies. While it is possible to sort out parts of a tragic play into the functions of spectacle, melody, diction, Plot, character, and thought by, for example, performing the songs of the play separately, or as Aristotle is fond of claiming that simply reading a play is almost as good as having the spectacle performed on stage, all are required for the complete experience of the imitative power of the play. Tragic plot then is not another species: it *is* the first actuality of one species, Tragedy-itself. Comedy will have a different kind of plot.

Then comes the teleological subtlety of a great humanizing thinker, someone that truly formulates and advances culture. Tragedy is not simply another species of imitation, it is the best species; it ranks first and foremost among them, so in a nuanced way it becomes the exemplar for poetics-itself. While Tragedy is not fully coincident with the whole of poetics-itself the way tragic plot is for Tragedy, it is teleologically the most important species because it presents the best and most ennobling catharsis amongst them all. Each of the four causes works to sort out and order its specific phenomenal appearances. Thus, the kind of catharsis that any tragedy aims at also serves to order all the significances of the play, and to also order the powers and imports of the different species of imitative making to its highest standard. Tragedy rises to the top of this ordering across all the causal functions, even though it shares some with others, but not all in its unique combination of them. Tragedy and Comedy overlap in their material causes, and similarly with a shared dramatic manner, while ranking differently in their objects of imitation. Aristotle is not only "saving the phenomena" – his intent is aimed at saving *the better* phenomena as such.

As Tragedy stands at the top, so does Aristotle's poetic science of Tragedy. While everyone might be able to appreciate such a combined achievement of poet, performer, and productive scientist, not everyone can be original at Aristotle's high level of *conceptually productive ambiguity* so as to scientifically ground and scaffold the expressive activities of poets, audiences, and critics. Aristotle develops a theory of tragedy at the highest level of human intentionality so as to best facilitate catharsis (Dunbar 2008 pp. 403-423, 1998).

<u>'Plot' as the vehicle of catharsis as a 'Teleological Consummatory Act'</u>

Returning to the above sequence of techniques, their increasing scientific concreteness is built around the development of two technical terms that work to capture the conceptual *substance* or form of the science of poetics-itself: 'plot' (*muthos,* μῦθος) and 'concrete, composite whole' (*tó súnolon,* τὸ σύνολον). These two terms are "contentful" as distinct from the other terms in the opening sentences which are either "metascientific" such as "species" and "parts," which have to be differently adapted to each science; or directly and endogenously phenomenal such as "epic" and "tragedy" along with the causal terms such as "in which" for material causation, which are discursively deictic for its material phenomena. Carried through for all four causes, the deictic "pointing" to the phenomena achieved by plot and art work take on additional discursive significance in the reader's experience. As we have just seen, 'plot', first uttered in sentence 1, emerges as the central concept for its role as the soul of tragedy. The above sequence of scientific techniques *constitutes* the subject matter of poetics for the synthesis of the tragic plots. As we will see in Scene III of this overview, the scientific term 'concrete, composite whole,' introduced in sentence 2, plays a coordinated role parallel to the development of 'plot'. It provides a unifying concept for the variety of specialized structures and functional relationships exhibited by a *poem* or work of imitative art, such as the system of six parts of tragedy as a whole, and the three formal parts of thought, action, and character of plot as a whole. At the point in chapter 6 where Aristotle has established these three terms: character, plot, and thought, readers gain indications of the highest-level formal causes for poetic synthesis. Along with the inner parts of plot-itself, these indications provide the phenomenal "first things" required to lay out an idealized sequence of pulling together all the parts of tragedy in service of the best possible catharsis of fear (*phobou,* φόβου), suffering (*pathos*, πάθος), and pity (*eléou*, ἐλέου) (*Poet*. 11. 1452b10-1452b13).

In general, the above higher-order functional articulation of plot *as form* is also telic in its function and ordering. It gives us the potential (*dunamis*) of an overall human significance, a human universality of imitative making, that arises out of how we act when "we take pleasure in contemplating the most precisely made images of things which in themselves we see with pain, for example, the visible shapes both of the least estimable of beasts and of corpses." (4. 1448b10-13. Benardete/Davis) That is, this higher-order formal effectiveness is co-constitutive with overt telic significances for a *more powerfully complete* working or functioning of the plot. Such greater functional articulation of the formal coherence of the parts is poetic necessity for its own sake; for example, it ties the plot into the first-order depiction of the lesser catharsis of suffering provided mostly through the use of *diction, melody,* and *spectacle* to present "murders, tortures, and woundings" (11. entire and 1452b9-13 especially). Such complete formal and teleological coherence is essentially required for the embodiment and presentation of the best plays. When the triple of [poet | poem | audience] is enacted the experience is *productive* and *performative* throughout.

In order for us to recapture such telic poetic necessity for our own cathartic needs, we can start by adapting a modern scientific term from biology, viz. Mayr's 'teleonomic consummatory act'. Adding the modifier "teleological" to the rest of Mayr's phrase "consummatory act" to get 'teleological consummatory act' adds a new family member to Mayr's use of "teleonomic consummatory act." (Mayr had originally included 'teleological' in his consummatory terms, but later dropped it.) Accordingly, Aristotle's model or pattern (*parádeigma*) of cultural unification takes place as and through a '*teleological* consummatory act'[35, 36, i] of imitative making (*mimêsis*

[35] Phillip R. Sloan's work (2012, 2011); Mayr (1974, 2004) and Robert Richards (1992, and Workshop on Science and Aesthetics 2011) helped lead the way in formulating my reinterpretation of Mayr's term. That assistance does not claim to enlist their acceptance of my adaptation.

[36] Of course, there is room for terminological controversy with Ernst Mayr's uses here. I am abducting a wider interpretation of his exacting work on the phrase "teleonomic consummatory act" to bring forth how it ought to include recognizing that a tragic play formally embodies a noble and beautiful catharsis in a plot with the potential to satisfy and complete a person's self-understanding through the resolution of fear, pity, and suffering as an *active telos* for our human activities. Such a meaning for the concept of "consummatory act" is emergent in Mayr's very rigor of excluding "teleology" from the principles of the science of biology. He effects this exclusion through his reduction or elimination of an external "evolutionary telos" by rejecting an overt teleological cause at work in the physics of life. For Mayr and other scientist/thinkers, it is clear that assuming such a "final cause" would obscure the deep nature of living things as both physical motions *and* living activities (*De An*. *ii.* 1. 412a10-b9) rather than clarify it. In that sense, the biologist's scientific rigor already posits biological science as a *vocation* (Weber 1918 (2004)) that separates facts from values by the very act of excluding the discussion of *intrinsic ends* for the evolution of living things. Biologists do this reduction even as the same biologists constantly posit particular ends for individual creatures in order to conduct their science in *practice*, as distinct from theory. Biologists must posit teleology *in order to rigorously disclose the higher complexities of living things*, even as they eschew it as an external physical cause. Precisely because of this more complex sense of rigor, which exceeds positing

poíêsis) for the good of city and citizens by means of its beautiful and ennobling performance to an audience culturally situated to be responsive to its actions. In other words, Aristotle's higher-order conceptual articulation of a synthesis of the tragic effects of pity and fear into the plot is constitutive of a scientifically idealized cathartic functioning of thought and character within the actions of the plot as a whole. Together they actually *produce* and *perform* a politically and ethically satisfying completion of human cultural experience for the Greek polis. Moreover, to some definite extent, such 'tragic effects' have the power (*dunamis*) to constitute humanly

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universal laws of mechanical nature, biology is replacing physics as the model for all science including the human sciences. In a sense, Mayr (1974) would be perfectly in accord with the addition of "teleology" to the legitimate meanings of "consummatory act" as he says: "Intentional, purposeful human behavior is, almost by definition, teleological." His proviso is that such meaning should be excluded from an explanatory role in factual bioscience. My intention is to extend and complete-in-principle the range of Mayr's terminological work in the realm of human activities and culture.

What I want to make clear is that the poet's works *exceed the programmable* in the sense of an algorithmically necessary procedure that guarantees catharsis for particular individuals in the way that Mayr invokes teleonomic "programs" for life-forms, i.e., without the organism's awareness of desire and purposiveness. Clearly, poets must *purposively work from their own experience* to create the effects of their plots and plays that signify such an end, regardless of their particular story contents or degree of success. Mathematics and mechanism are not the only loci of precisions and functional power. One of our most important concerns today is not that a program could not arrange a work of artistic components as some simulacrum, which has been happening for quite some time, but rather how people could use programs *to do so* in new and culturally completing ways in our increasingly complex lives. Under this wider interpretation, such an intended catharsis does indeed constitute a "teleological consummatory act" as situated in the fullness of a particular human individual, culture, and community. All of which is increasingly understood as intrinsic to the human species as it becomes clear that we have actually co-evolved with our culture. Hence the addition of "teleological" as a legitimate modifier of "consummatory act," while also maintaining the biological rigor of "teleonomic consummatory acts." Both terms – 'teleonomic consummatory act' *and* 'teleological consummatory act' – need to be kept. Aristotle's productive and practical sciences understood these aspects of humanity much more insightfully and directly than modern scientific reductions allow, and Aristotle's understanding is something we have lost a concrete grasp of. This interpretation broadens Mayr's uses but in no way discards them. (See the Endnote i for Mayr's definition of 'teleonomic', and further discussion. Also see Dupré 2005 for scientific problems with technical terms such as "gene" in biology.)

specific experiences as potentially open to phenomenal determination across varying historical and cultural situations. Once codified, they have the ongoing potential for human universality through other culturally situated recoveries. In these senses, “tragic effects” are real for people and cannot be reduced to purely physical phenomena. They are an intrinsically teleological activity even though they cannot be abstractly specified in their particulars and concrete influences as *had* by people. In Kant’s terms, they are “purposive without a [fully determined conceptual] purpose.”[37]

Within my limited textual focus of chapters 1-6, the above ‘procedural reenactment’ of Aristotle’s treatment of “tragic effects” discloses something of the exemplary character of Aristotle’s continuous “run of argument” through discourse. The run of argument conceptually begins with the metascientific term “species themselves” (*eỉdôn aủtês*) as it first occurs in Greek sentence 1; moves through the introduction of “tragedy” as an endogenous term for phenomena arising in the Greek city-states as one of the six primary poetic species that first occurs in Greek sentence 2; and then is carried forward beyond chapters 1-6 throughout the entire schema of the initial four stages of applied scientific practices. The scientific term is then positioned as thoroughly thematic for the fifth stage which treats of the noble/good synthesis of plot. This continuous run of text constitutes an “argumentative sequence” utilizing *multiply related* and *specialized* scientific terms intrinsic to the productive science of poetics itself (*poiêtikês aủtês*)

[37] Kant’s productive ambiguities lie along a different, epistemological, approach to art wherein he finds human universals in the powers of imagination instead of imitation, and orders the experiencing of art according to the purposes and moral relations between the pleasurable, the beautiful, and the good in terms of human “liking.” (*COJ* §5 “Comparison of the Three Sorts of Liking, Which Differ in Kind,” pp. 51-63, Pluhar trans.)

that would be difficult, if not impossible, to expound in any other way than through extended natural language discourse.

The multiple consequences of Aristotle's idealizing argument constitute the facilitation of the poet's work to produce a full cathartic effect. This effect is achieved through the essentialist metapragmatic signaling entextualized by the *Poetics* through the poet's imitative making under the text's influence. That influence allows artists to construe the actions being imitated in the dramatic interactions of the plot of the play in such a way as to make them engaging for the audience in their specific experience of the plot for themselves and for their city (Felson and Parmentier 2016, and Parmentier 1994). This metapragmatic signaling is possible because philosophic science is more conceptualized than poetic imitations, which in themselves are more universal than the singulars of history and circumstance (1451b1ff.). Aristotle's more abstract reformulation of a unity of thought, character, and action as a productive mode of plot synthesis amounts to "taking on a life form" for the poet as well as the spectator. His more intricately articulated plots with their own parts thereby become a *more ordered* meta-conceptualization beyond that of the poet's more intuitive inventions and stochastic improvisations (chapters 4-5); this meta-conceptualization is potentially elevating and synthetic for the poet's process of imitating.

Future Technical Focus: Exegesis of Stage 5 (poetic synthesis) and Stage 6 (resolution of the problems of criticism and appreciation) of the science

With regard to my heuristic schema of six stages of scientific development, this detailed exegesis of the first four stages (in chapters 1-6 of the *Poetics*) can provide a new framework for understanding the remaining two stages (chapters 7-22 and 23-26). For the remaining chapters, the central problem is "What is the *synthetic* (*sunístathai*, 1445a9, 1451a29, 1453b4, 1455a22) function of chapters 7 to 22?" In these chapters, Aristotle lays out an entire matrix of poetic relationships between the primary part of plot and the other five parts that all together constitute the whole of Tragedy.

For the fifth stage of the science, the most deeply entrenched, traditional approach is that it provides "rules for poets." In a basic way, this interpretive commonplace provides a key insight into the workings of the science: in this section of text, Aristotle is *doing* something on behalf of the poetic process of synthesizing noble/beautiful plots. And indeed, over the ensuing millennia, poets have turned to the *Poetics* and found helpful insights.[38] The recurrence of this "rules for poets" interpretation is a transhistoric and transcultural opinion (*endoxa*) "worth saving."[39] Yet the phrase "rules for poets" goes nowhere near enough to fully exhibiting Aristotle's *Poetics* as science of the 'productive and performative essence' of imitative making (*mimêsis poíêsis*) by means of higher-order heuristic procedures of composition. Moreover, such synthetic functioning is not the end of the problematic of the *Poetics* as a whole: how is the idealization of plot synthesis in tragedy (chapters 7-22) related to the concluding four chapters?

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[38] Without doubt, the *Poetics* has been the basis for many helpful recapitulations and extensions that begin poetic science anew through neoteric inquiry. Two exemplary contemporary ones are Wayne Booth's *The Rhetoric of Fiction,* which adapts Aristotelian topics and insights to the literary criticism of novelistic literature by transforming them into the explicit metapragmatics identified with rhetoric; and Brenda Laurel's *Computers as Theatre* for both the more technical first edition and the more popular second, through her transformation of "arc of plot" and the "four causes" into effective and user friendly software design. There are many other "*Poetics* for writers" handbooks. Averroes' commentaries for an Arabic community is one historical instance (Butterworth 1986).

[39] Arist. *N. Ethics*, *vii*. 1. 1145b1-7: "We must, as in all other cases set the observed facts (*phainomena*) before us and, after first discussing the difficulties, go on to prove, if possible, the truth of all the common opinions about these affections of the mind, or failing this, of the greater number and the most authoritative; for if we both refute the objections and leave the common opinions (*endoxa*) undisturbed, we shall have proved the case sufficiently." (Ross trans.). G. E. L. Owen 1975, Nussbaum 1986.

As a sixth, final stage in scientific inquiry with regard to works of tragic action, in chapters 23-26, Aristotle explicitly treats the particulars of the problems of a similar species (epic), the standards for poets, and the criteria for criticism. Saliently, this treatment reaches back to Greek sentence 1, in which he closes the theoretical statement of the method of the *Poetics* with the apparently minor systematic goal of "and likewise of any other matters in the same line of inquiry."[40] There is more to this closure than "leftovers." First, there is the well-known issue: was there or could there be a continuation of the *Poetics* treating the similarities and differences of comedy? Such a continuation could definitely be a part of the problematic of a systematic closure for poetic science, and this issue has engendered a great deal of scholarship about comedy. However, a deeper scientific issue for the whole of poetics consists of the 'duality' of a proper resolution of the opposition between making any sort of poems versus criticizing them.

This 'duality' between production and criticism also reflects the problem of systematic closure from the poet's point of view. The catharsis of suffering, pity and fear is not the stopping point for an actual tragedy; it is engendered by the crisis at the middle of the arc of the plot. The poet must also imitate incidents of resolution or unravelling (*lúsis,* λύσις, 1454a37, 1455b24). Oedipus must be shown in the humility of his excessive hubris, and the community of Thebes must cast him and his family out of the city, even as the chorus pronounces to the audience:

> "You that live in my ancestral Thebes, behold this Oedipus, … Look upon that last day always. Count no mortal happy till he has passed the final limit of his life secure from pain."[41]

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[40] <u>περὶ</u> <u>τῶν</u> <u>ἄλλων</u> <u>ὅσα</u> <u>τῆς</u> <u>αὐτῆς</u> <u>ἐστι</u> <u>μεθόδου</u>, 1447a11-12.

[41] Lines: 1723-28, David Grene trans. My thanks to Heather Brink-Roby for pointing out this mode of poetic universalization.

That resolving incident in itself is also a pathway to further *mimêsis* beyond a single play. Oedipus does not exit the stage forever after *Oedipus Rex*. Sophocles returns him to the stage in *Oedipus at Colonus*, and the children of the family return as well in *Antigone*. All together the cycle of tragedies provides a sort of encyclopedic closure for the troubled offspring of King Laius and Queen Jocasta. The individual plays taken in Sophocles' cycle provide a finite, albeit tragic, resolution for the various characters in the dramatized city. (This complex "duality" of poetics and *poiêsis* has a formal analog in the treatment of Aristotle's small finite model of poetic species, within a sequence of similar models, which will be analyzed in a later section, below.)

On the whole then, across Aristotle's scientific stages, I propose that not only is plot the analog to soul for tragedy as Aristotle explicitly states, but also that the purpose of poetic science is to provide a first actuality for the *poetic process*, the *exercise of poetic art*, in the idealized context of the best and most ennobling species, viz. Tragedy as situated in the ancient Greece of Plato and Aristotle (Lear 1998, p. 182). The *Poetics* provides the performatively essential form that the activity of the poet realizes in her synthesis. Put in terms of a discursive achievement, the *Poetics* is written to produce metapragmatic effects through a mode of discourse (Felson and Parmentier 2016) that will scaffold and complete the poet's synthesis in ways that bring poetry back into the community or "city" of the poet through the catharsis of various manifestations of pity and fear as well as suffering. That is the technical and telic end in sight, the formally higher-order teleological consummatory act, for Aristotle's science. The current project lays the ground for this interpretation by looking at the theme of "turning the soul around" (*tes periagoges* and *metastrophe*, *Republic* 518d3-4) as a humanizing concern of which Aristotle was well aware as a student in the Academy.

Hence, the primary goal for a future extension of the current exegesis is to disclose Aristotle's method for synthesizing a beautiful/good plot in chapters 7 through 22. In this extension of my exegetical project, I will argue that he develops a scientific mode of metapragmatic integration akin to the Platonic "turning around" or *periagōgē* that both scaffolds and unifies the poet's process of pulling together (*sunístasthai*) a specific plot or "life-form" for the story and catharsis of the particular tragedy she is making, a process which I name "panduction."[42]

«Third Interpretive Goal: *To Formalize Aristotle's Discursive Exemplar of Species Differentiation by Modeling»*

Our current focus in on the fact that the text encodes a structural and functional model for species differentiation in a way not entirely dissimilar from how the ancients expressed mathematical relationships verbally. Formal symbol systems *per se* were not available to them and yet they managed to turn natural language to the task in ways we can productively continue to ponder and explore. Elucidating this model structure through "heuristic reconceptualization" (Wimsatt 2007, chs. 6, 7) and "procedural reenactment" (Collingwood 1946, 1939; Richards 1992) constitutes the third goal for this project.

Demonstration that the first three chapters present an Ordered Sequence of Selections[43] from the Whole of Poetics-itself for the Different Kinds of Phenomena, each according to the Poet's Different Capacities for Imitative Making – an *Instance of Polyvocality in Discourse*

[42] My thanks to Richard Parmentier for suggesting this term as a better alternative to my "circum-duction."

[43] Dewey 1938, pp. 117-118, *passim*.

In chapter 1 of the *Poetics*, Aristotle's scientific procedure for the determination of the quasi-genus of poetics-itself through the differentiation of the artifactual species-themselves begins with:

> Just as color and form are used as means by some, who (whether by art or constant practice) imitate and portray many things by their aid, and the voice is used by others; (ὥσπερ γὰρ καὶ χρώμασι καὶ σχήμασι …, 1447a18. Bywater)

Then this process of differentiation takes place in a continuous sequence until Aristotle sets about defining tragedy at 1449b22. The conceptual structure underlying this process is that *the poet* is the primary causal agent in imitative making. It is the poet's agency that transforms the different human capacities for imitating into works of art. The poet's capacities to use some expressive medium to imitate actions of agents with a specific character acting and in a particular style or manner afford the poets with different kinds of resources for creating their art. Only within that process of imitative making can the different capacities be taken as different "resources for poetic causation." In this sense, the specific differentiations of means, objects, and manners have been sorted into different kinds of potential causation in the determination of which resources are used to make the different species of art. Poets have different degrees of excellence as artists, and accordingly, the level of and mode of artistry differs between poets, a fact Aristotle consistently points out. Consequently, a given poet's ability to use figure or voice as a means, or to choose certain kinds of action to imitate, or to have a particular style, varies considerably among poets, and these abilities are not universally the same for all poets. That is why Aristotle does not attribute direct causality to the capacities as such.

However, in chapters 4 and 5 he explicitly attributes causality (*aitia*) first to the *humanly universal capacity to learn and delight in imitations* and second to the *history of actual poetic achievements as artistic agents.* This explicit attribution gives us a polyvocal argument by interweaving the 'systematic plurality' of different modes of causation wherein the initial discussion of the poet's capacities in sentence 2 involves the causes as separably different factors of poetic agency in the making process. The developing argument only reaches productive consequences when the poet's agency is coupled with the universal human capacity to appreciate imitation-itself in poetic events or artifacts. Nonetheless each of the methodical steps in the argument deals with causation according to Aristotle's general theory of the four causes – material, formal, efficient and final. As Collingwood (1938) and Dewey (1934) would agree, it is only by engaging in the functional whole of the poet's makings, the audience's receptivity, and the culturally situated artifacts and events in which and for which poems are made that we can interactively enjoy the proper pleasures of poetics.

With this underlying conceptual structure in mind, we can make good sense of how Aristotle's four causes are put to work specializing the science in the initial five chapters. In this section of text, Aristotle adapts the generalized system of four causes to the specialized method (*methódou,* sentence 1) required for constituting the productive science of imitative making. The *poet* is the primary cause of her *poems* through exercising her particular capacities for making in which, of which, and in what style, and thereby allowing different poets to constitute different species within the quasi-substance of *poetics-itself* by means of the process of *imitative making* (*mimêsis poíêsis*).[44] In a modern context, we could substitute "scientist" for "poet" and get a more fruitful understanding of the human pragmatics of how science is produced.

These five chapters in the *Poetics* codify Aristotle's step-by-step dialectical process for the definitory comparisons and contrasts of poetic species (*eỉdôn aủtês*) for the whole of poetics-

[44] My express thanks to Robert Richards for indicating the need to explain how Aristotelian "causation" is a proper frame for interpreting this passage.

itself (*poiêtikês aủtês*) according to the specialized differentia appropriate to each of the four causes in this sequence:

[material ➛ formal ➛ efficient ⇛ final causation].[45]

We could also represent this sequence graphically:

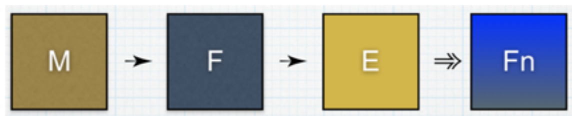

Fig. II-1 Graphical Sequence of Causes

Reading along in the text, we experience this process of differentiation as containing a great deal of complexity and nuance that we have to adjust to mentally by taking on the different causal views of the same whole of poetics with each differentiation according to one kind of causal factor. What I am asserting here is that each chapter performs its differentiations within a single kind of comparisons and contrasts. For example, after the opening two sentences, chapter 1 lays out a well-ordered sequence of differentiations between the genres or species within the domain

[45] It is important to keep in mind that I am placing or abducting the interpretive frame of textually separable causal accounts on chapters 1, 2, 3 and 4 & 5 even though Aristotle does not explicitly assert these as different categories in this text (although he does make explicit remarks in other texts such as the first 4 chapters of *De Anima* bk. *ii*). The changes in the accounts through the plurality of different causal points of view on the whole of poetics-itself take place according to the received chapter divisions with the poet's use of material causal capacities of figure, color, rhythm, speech, and harmony in chapter 1, the formal causes of noble and base actions in 2, efficient causal factors of narration and drama in 3, and universally telic causes or aims of imitation to produce learning, delight, and poetic enhancements through artistic improvisation in 4 & 5. The anonymous editors that provided the chapter divisions we currently use were very sensitive to such shifts. I change to a double arrow "⇛" in this sequence of differentiations according to the analytic variety of causal factors to signify a definite shift in method for treating final causation in a teleological manner with the first three causes being "theoretical" capacities of the poet and the fourth, final cause, as empirically evaluative in both human universals and the historical development of the arts. This abduction of different causal selections is an instance of heuristic reconceptualization in order to find a more adequate model of the text that can ideally account for all the levels of discursive content across multiple levels of discursive granularity from *micro* to *meta* syntax, semantics, and pragmatics. (See later treatment in Scene III, section "*Two Warrants for this Interpretive Method.*")

of imitating “in which” variations. That is, the genres are compared in a sequence from less complex to more complex strictly according to their differences in the use of poetic means or media, viz. color, figure, voice, harmony, and rhythm. Chapter 2 follows a highly similar sequence but compares and contrasts the species according to their capacities for imitating the three *ethe* of noble, as-we-are, and base agents. These differences are strictly ones of ‘what’ is imitated, the objects of imitation, i.e., the characters of the actions imitated. The differences selected and ordered according to the specific contraries follow in the sequence of [color | figure | voice] in chapter 1, and [noble | as we are | base] in chapter 2, and [narrative | mixed | dramatic] in chapter 3. Here is a table of the qualitative details of these qualitative orderings as selected for chapters 1 and 2. The table presents the literal sequences of the arts and their utilization as causes by poets in making a work of art in chapters 1 and 2 at a small or micro scale of discursive details:

	Literal Sequence of Ways of Imitative Making in Ch. 1		*Literal Sequence of Ways of Imitative Making in Ch. 2*	
	Ways of Making	**Means Used**	**Ways of Making**	***Ethe* given by Poet's Name**
			{group reference}	**[noble ⇑, as we are ⇔, base ⇓]**
1	(painting/visual arts generally)*	color & figure	painters	⇑Polygnotus, ⇓Pauson, ⇔Dionysius
2	(song/aural arts generally)*	voice	{not mentioned as already subsumed}	
	{group reference to 6}	**[rhythm, language, harmony]****		
3	flute playing	rhythm & harmony	flute playing	range of 3 *ethe* found
4	lyre playing	rhythm & harmony	lyre playing	range of 3 *ethe* found
5	dance	rhythm	dance***	range of 3 *ethe* found
6	nameless art	language with or without meter	nameless art (prose & verse)	⇑Homer, ⇔Cleophon, ⇓Hegemon, Nicochares
	{arts below combine <u>all</u> means enumerated, including melody or song, and meter as a species of rhythm}			
7	dithyramb	rhythm, language, harmony	dithyramb	⇑[break in text} Timotheus, Philoxenus
8	nome	rhythm, language, harmony	nome	⇓{break in text}
9	tragedy	rhythm, language, harmony	tragedy	⇑imitates better people
10	comedy	rhythm, language, harmony	comedy	⇓imitates worse people

Table II-1 Closely Matching Sequences of Arts in Chs. 1 & 2 with their Causal Properties

> * Art(s) not explicitly named at this point in text, they are only generally indicated by their characteristic means. ** In general all six species in the group of sentence 2 make use of these. ***Dance is literally 3rd, but part of a list including flute and lyre playing. I've taken the liberty of listing it 5th instead of 3rd. One could also argue for placing dance 3rd under means to begin with because it uses only one means. See Appendix B for transliterated Greek, and Appendix C for the Greek with the order of arts marked.

There are many interesting things to observe in this arrangement, but before we consider the definitory dialectic with its overall sequential coherence as arranged according to separate kinds of poetic "capacity," there are three key <u>literal</u> features of these compared sequences of ways of making to take note of. These are literal facts of the text regardless of their interpretations. 1) The order or arrangement (*taxis*) of the sequence of arts mentioned in the Greek under *means* and *objects* is reasonably taken to be the <u>same</u> in the two separate chapters, where "reasonably" means "for the most part." (It would be unreasonable to expect such a poetic manifold to ever be strictly linear or "lie flat" in a modern formally univocal account.) 2) The same arts on the list of specialized ways of making are shared by each sequence in the different chapters. 3) Also, a surprising occurrence emerges in the treatment of actions and agents imitated: instead of the means being mentioned again in chapter 2, specific poets are named and their tendency to each make one kind of poem is introduced as a new kind of difference where there are new technical terms for character variations used to refer to the same list in the same order as those for the media variations in chapter 1. Moreover, each of the different artists is consistently presented in the order of that poet's kind of agents imitated: "above our own level of goodness" is always first, and then either "base" or "as we are" follow. For example: "the personages of Polygnotus are better than we are, those of Pauson worse, and those of Dionysius just like ourselves." These three literal facts provide very strong evidence that Aristotle was indeed keeping his view of the arts as a whole constant even while changing the selections of specific phenomena.

Following the Aristotelians of the Chicago School,[46] I too assert that the sequence is actually the sequence of different causal accounts of the poet's capacities given above: [material ➛ formal ➛ efficient ⇛ final causation][47], and that this constitutes one of Aristotle's scientific techniques for determining *arithmoi* of phenomena. The way that this sequence of text constitutes an instance of 'polyvocality' is that Aristotle uses the different contrary ranges for

[46] A key resource for the Chicago School of Criticism is *Critics and Criticism* (1952), throughout, and in particular for Aristotle, Olson's "An Outline of Poetic Theory," sections II and III, pp. 552-563.

[47] Once Aristotle has established the identity between the material and the formal factors in poetics-itself in chapters 1 and 2, the differentiation gets less specific for differences in manner in chapter 3. By that point in the argument, Aristotle is taking on the next problem of discerning the three most imitative and important species: Comedy, Epic, and Tragedy while beginning to leave the other species behind.

poetic phenomena as "selective" filters for identifying those particular phenomenal aspects that constitute each kind of causal function. In effect, each contrary such as [noble | as we are | base] is a "qualitative data structure" that provides one step or phase of the intelligible ordering and sequencing of the phenomenal manifold necessary for the scientific practice of performing a complete differentiation of the poetic capacities exercised in the whole of poetics-itself. The method of differentiation uses each different contrary as a way of selecting out just those qualitative phenomena that it allows us to notice. That is, the separate contraries save the different phenomenal aspects for the purposes of poetic making and appreciating. The *separate contraries each give a different voice to the phenomena* found in the whole of poetics-itself. Moreover, these *different voices are consistent across differences in kind and consonant in their co-functioning within the various species*.

The well-ordered experiential complexity of different causal factors observable in the whole of poetics signals an important deficiency in both the verbal and especially the visual representations I have given above: each of the causes appears fully separable from the others. That apparent separation is definitely a wrong interpretation because Aristotle is quite clear that each cause is already at work in the others, even as each of the different causal selections performed "in thought" brings its own phenomenal aspects to the fore. The sequence is actually quite dynamic and involves *rearranging the whole manifold* of poetic species phenomena with each causal shift in order to let each kind of poetic aspects show forth as themselves. That "rearranging" carries argumentative force as well as the aesthetically sensitizing shifts in selected phenomena. Aristotle even makes an explicit reference to such coordinated separation of phenomenal factors with regard to poetic manners or styles in chapter 3:

> Given both the same means and the same kind of object for imitation, one may either (1) speak at one moment in narrative and at another in an assumed character, as Homer does; or (2) one may remain the same throughout, without any such change; or (3) the imitators may represent the whole story dramatically, as though they were actually doing the things described. (1448a19-23)

The epistemological status of Aristotle's system of four causes is that of an ordering of the functional whole of poetic qualities

For further elucidating this structural and functional model, it could be helpful if we could get some intuitive sense of how discursive complexity builds as the separate causal differentiations proceed, each building on the previous one. Aristotle's clarity of expounding each cause one after another allows us to visualize the underlying increase in significance as each cause "adds" complexity to the significances of the previous one in the sequence, because in reality all four are coincident at once in an actual work of art.[48] Verbally we get what appears to be linear accretion, as in the above verbal and box diagrams. What we are looking for here is how and through what methods does Aristotle build argumentative force or productive consequences in expounding a science of poetics? In this segment of text laying out causal cross-differentiation and functional integration, Aristotle is training and refining the poet's aesthetic sensitivities for exercising arts of phenomenal discrimination and articulation through the study of the Greek artistic canon as a whole.

Conceptually, each new cause is "carrying" the previous one with it as now made phenomenally coherent through differentiation of its specialized kind of variations across species. "Carrying forward" like this maintains a consistency of signification to the functional whole of poetic appearances, even as his focus on particular species is constantly adding the

[48] For more details, see Appendix A for a mid-level or 'meso scope' schematic abstraction of the differentiations taking place for each step of the sequence.

complexities of differentiation. What Aristotle says about formal causes in chapter 2 is built on top of the material significations of chapter 1, and so on. In a visual metaphor, this causal "adding" could look something like this, where the column of four on the far right indicates the increase in complexity reached by the end of chapter 5:

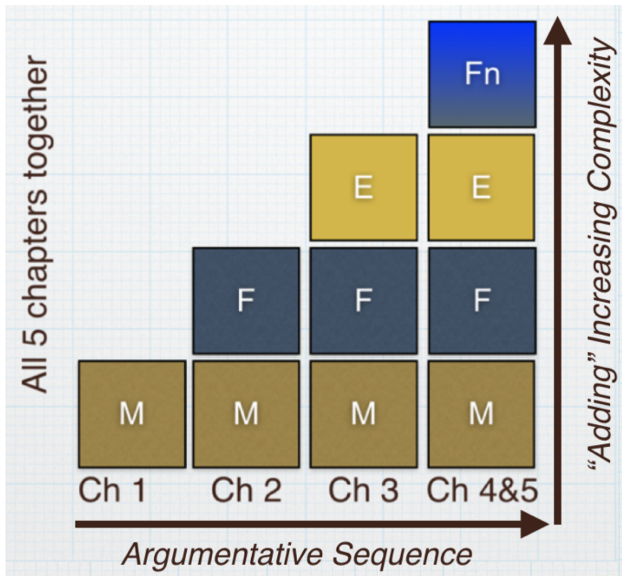

Fig. II-2 Graphic of Cumulative Four Causal Sequence

We can now attend to the "dynamic" or functional aspect of Aristotle's new science. We can see the "deepening" of the grasp of the whole of poetic phenomena in all their causal modes as the causes functionally coincide or "stack up." But what about the causes' overall co-functioning for generating the rise of different species or genres of imitation? How does all of that causal overlapping and interaction work out in the differential ordering and expression of the science of poetic phenomena?

We can catch a glimpse of some of those dynamics by bringing final causation in as also coincident with the whole. This deepening telic grasp produces a "completing" complementation effect that increases the density of significance even further by its multiple recurrences across all the causes. We can see these recurrences at work in the next section of text chapters 4 and 5

(1448b19-1449a8), as Aristotle turns his examination towards human universals as explicitly named causes (*aitia*) and the historical contributions of poets to the formation of genres as various kinds of improvements made by poets. For an example of recurrence, we notice the characters of the poets themselves led them to favor the kinds of agents acting according to the poet's own dispositions:

> Poetry, however, soon broke up into two kinds according to the differences of character in the individual poets; for the graver among them would represent noble actions, and those of noble personages; and the meaner sort the actions of the ignoble. (4. 1448-b24, Bywater)

Poets as human artists are not separable from their imitative making. Accordingly, Aristotle goes on to bring in the "natural" or endogenous use of varied modes of speech as suited to the poets' own characters with the meaner sort turning to invectives or "iambs," and the nobler poets choosing panegyrics or "heroic" verse, thereby co-determining different means of imitation. He carries this sort of co-determination to include a continuing ratio for efficient causes:

> Just as (*hwsper*) (Homer) was in the serious style the poet of poets, standing alone not only through the literary excellence, but also through the dramatic character of his imitations, so too (*outws*) he was the first to outline for us the general forms of Comedy… (4. 1448b34)

Eventually through the improvisations of the poets these causal factors led to the emergence of the various genres, and as excellence came to the fore the best and most imitative species of Tragedy, Epic, and Comedy took their distinctive forms.

'Teleology' here amounts to the characters of poets following their own inclinations in their imitative making while using the means, agents, and styles universally available to all people for works of art. Poets are also embedded in their own time, place, and developing culture since these factors influence imitation. This situatedness is as much the case for artists now as it was in ancient Greece. Artistic teleology takes place in the realm of human actions and activities as organically structured consummatory acts that make things in the world in relation to the very community they live and work in. Consequently, this sequence of four causes has its own built-in satisfactions that can also show forth in experience. Aristotle exhibits his combinatoric differentiation of the whole of poetics-itself in a satisfyingly coincident or “final” way as a functional whole that tracks the actual order of his separate treatment of the causes discursively in chapters: 1 – material, 2 – formal, 3 – efficient, and, *telicly doubling-up* cause <u>and</u> history (*aitiai <u>kai</u> istoría*), in 4 & 5 for final causation.

One way to understand such a telic “doubling up” or purposive completion is to notice the *return* to the prior causes (from chapters 1, 2, and 3) in the section of chapter 4 (1448b24-1449a6),[49] right after Aristotle finds the fourth kind of causation in the universal human capacities for delight, learning, and rhythm. This return is particularly interesting here in that it rehearses our understanding of the apparently fixed qualities delineated by the three prior causes, but now in the context of final causality of the poet’s arts and universal human powers for delighting, learning, and rhythm that unite poets with all of humanity. That is, Aristotle introduces an *evaluative frame* for each return to formal, material, and efficient causes qua the three most important species of Tragedy, Epic, and Comedy, as they consistently emerge in the successive rankings of the highest species in their imitative excellence in comparison and contrast to the other species. First, the character of poets is assessed as their natural inclinations are expressed in their choices to work in a given genre. Second, the “natural fit” of various meters emerges over time; for example, improvisations leading to the use of iambic meter rather

[49] See methodologically parsed version of the text.

than invective for comedy. Third, the excellence of dramatic over narrative imitations as marked by shifts of great poets towards drama reengages with efficient causation. The above cited texts in chapter 4 give explicit textual references for how the emergence of a teleological ranking of the imitative powers and their worth takes place simultaneously as the argument as a whole proceeds and can be discerned in the orderings under each cause.

Looking at chapters 4 and 5 together, a second way of noticing this "telic turn" is to realize that Aristotle's disciplinary history of the rise of poetic species is itself a recursion to the whole of poetic phenomena first captured in sentence 2. But now, in the rest of chapter 4 and in chapter 5, in addition to the already achieved causal differentiation of the completed phenomena, the rise of poetic species is explicated according to the different function of how the particular species phenomena changed over time to the point of achieving a social-cultural stability and then excellences. In these ways, the doubling-up and "telic turn" are actually *a crossing-with* and *a return to the phenomena already differentiated into species* through the details of their historical development from the standpoints of what are the natural end forms of the best species, and what are the causal standards relevant for the judgment of their artistic merit. These crossings and returns are reasons why the discussion continues to narrow its species focus along the way. Aristotle's teleological method of observing the cofunctioning of the causes and their recurrences upon one another grasps the most important functions of those species and simultaneously discloses the emergent best completions of the efforts of the poets.

Consequently, scientific methods with multiple causal coincidence *and* recursive returns to the phenomena from different functional frames are intrinsic to Aristotelian teleology. Such scientific methods *intensify the argument's reach into the natural origins of the phenomena*: these methods exhibit the properties and powers of Aristotle's '*arithmos* of causal phenomena'.

Only after building up such a more articulated and related grip on the phenomena does poetic science have sufficient ground to warrant a scientific definition of a singular species with its teleological catharsis of pity and fear. In reaching this end, the human universality of Imitative Learning and Delight in poetry finds its most excellent form in Tragedy, as evidenced by the history of artistic improvisations and innovations implicitly aiming at that end for the sake of fulfilling the benefits of imitative power and excellence in the city. The emergence of the telic ranking is another indication of how Aristotle's notion of final causation is at work throughout. His very assessment of Tragedy's worth for the city regulates or governs the inquiry's procedures.[50]

How might we represent this telic "doubling up" in Aristotle's '*arithmos* of causal phenomena' through an elaboration of our visual metaphor (figure 1) of stacked causes in the "Cumulative Four Causal Sequence"? In figure 2 for the "Four Causal Combinatoric," below, the visual metaphor is developed into a square in order to show the methodological steps of <u>recurring to</u> the causes and <u>turning to</u> the historical development of actual phenomena. Modifying the labels from figure 1, figure 2 shows "formal-under-Final" as "Tf," where "T" is for Teleological and "f" for final, "efficient-under-Teleological" as Te, and "material-under-

[50] This view of the argumentative sequence of causes in the text gives a new interpretation to Richards' "Four different levels of causality correspond to the divisions of time associated with narrative explanations" (1992, 36ff.) *Argument time* is here literally building greater and greater causal significance as each cause is explicitly combined "on top of" the previous to run along the "steel tracks of [poetic] causal necessity." It also leads to a notion of teleological time in which the causal cross-differentiations achieve sufficient scientific grip on the interactions of poetic phenomena that they allow for an internal working out of the coherence and increasing power of all those interactions. The beauty of this text is that as Aristotle merges the essential causality of imitative making with the discursive causality of his argument development, he literally ends up by turning to the history of poetic innovation to "finally" ground his theory of tragedy and catharsis as the depicted incidents of the plot in such a way as to provide artists and audiences enhanced access to the greater depths of catharsis.

Teleological" as Tm; and then turns the label upside down to indicate the "telic turn." Figure 2 for the "Four Causal Combinatoric" systematically completes the square of causally differentiable phenomena:

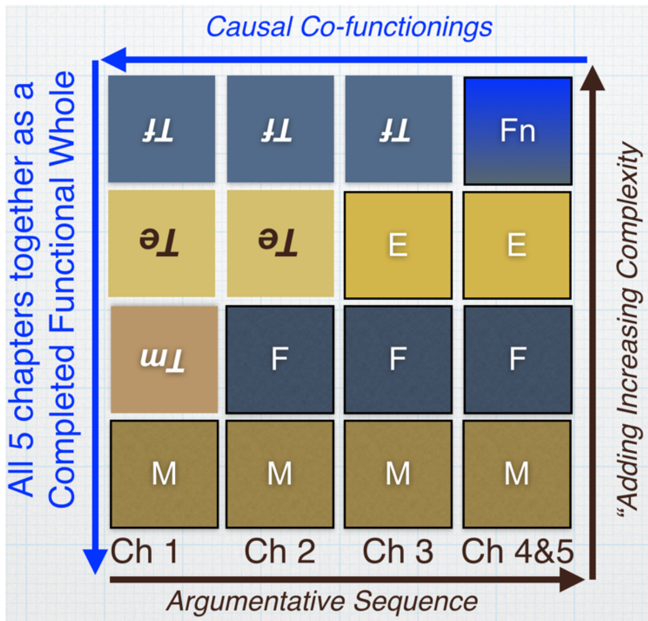

Fig. II-3 Graphic of Completed Four Causal Combinatoric

Suggestive perhaps, and certainly noticeable in the text, yet a diagram that any member of Plato's Academy would have been intuitively comfortable with in general, if not in specific. Still it is hard to determine just which cofunctioning returns and how many of them should be presented in a specific arrangement for "completing the square" of causal interactions. Just where should the Tf, Te, and Tm coincidences be placed? I will return to this issue in Scene III (under "A Discursively Recursive Return…") by taking some hints from chapter 6 with its explicit tracing of tragic parts to their causal origins. Here, the issue I want to raise is whether there are any modern perspectives that might give us a greater insight into how this process of differentiation functions? Let's start with laying down some facts about Aristotle's discourse that we could seek to model.

Aristotle's functional whole of causation as an extended combinatoric

My structural goal of laying out Aristotle's model originates in two facts. The first fact is that Aristotle's method of *causal* species differentiation is thoroughly grounded in the actual phenomena of poetry as captured through concrete references to them as individual works of art; his method combinatorically groups, regroups, and differentially classifies these individual works of art through the concept of genus/species relationships into differentiable poetic modes.[51] The second fact is that his science relies on a small finite model or conceptual structure of roughly sixteen possibilities for species arising from the qualitative cross-determinations of the four causes (4 x 4) at work; these cross-determinations indicate an underlying model of 16 possible species taken to instance the whole of poetics itself. Here then is a very simple "model" of the procedural structure. Since there are four causes that coincide in one thing of a certain kind, and since by nature the phenomenal aspects selected by each different kind are already co-functioning in the actual thing, we can plausibly represent these two facts together by "multiplying" the phenomenal aspects of the four causes:

[4 causes] x [4 selections of aspects] = 16 possible *unifications* into a distinct species-itself.

[51] Per the discussion in the previous topic, I will consider Aristotle's mode of concrete reference to the complex of actual phenomena presented by a quasi-substance as a "scientific *arithmos*" akin to the Greek manner of concrete numeric references to actual things in the world. Recapitulating, Aristotle's organizations by "nature" are not literal quantitative numerations, but rather the use of a *scientific procedure* for giving formal structure to phenomena. Such a scientific procedure is an explicit technique or method for referencing and ordering natural phenomena as concretely appearing things in the world with *qualitative properties appearing in different species groupings that are difficult to count "once and for all*." In an overly brief gloss for poetics, his proceduralizing amounts to developing a *combinatoric* of the numerous generic specifications in the varied dimensions of art objects provided by their particular means, objects, manners, and proper pleasures.

Even such a simple model may be of use; we can test this simple model against the text. Doing such a test gives us a modern way to intervene into Aristotle's discourse for checking the model's accuracy. This interpretive procedure illustrates what William Wimsatt calls using "false models as means to truer theories," which in our case is a testing of the "theory of the text" (Wimsatt 2007, ch. 6). The potentially "false" model stresses the "literal" continuity of Aristotle's scientific discourse with its ability to surface real aspects of species phenomena as "literally" present against a prediction of what the conceptual coherence of using a system of four co-functioning causes might actually be. Before testing against the text, we can elicit some possible formal implications from set theoretic notation to have in mind when we get to testing the text in relation to our multiplicative model of 4 x 4 causal relations.

<u>The formal suggestiveness of the set theoretic notation for a power set of 4</u>

We can obtain a more precise understanding of what the (4 x 4) "cross-differentiation" in Aristotle's method might look like by turning to set theory. Set theory provides an abstract structure for Aristotle's complex ramifying causal function-crossing <u>within</u> an *arithmos*: we can glimpse that functional interaction more precisely by abstracting from <u>Aristotle's substantive phenomenal content</u>. In order to disclose an underlying combinatoric form, we can conceive of the idealized power set of 16 possible combinations of the numeric elements of 4: {{1}, {2}, {3}, {4}, {1, 2}, {1, 3}, {1, 4}, {2, 3}, {2, 4}, {3, 4}, {1, 2, 3}, {1, 2, 4}, {1, 3, 4}, {2, 3, 4}, {1, 2, 3, 4}}, (with the sixteenth being all of them together as a whole[52]), as a means of indicating

1. [52] I take the collection as a whole of 16 as the completion of the "power set" operation, rather than the empty set, { }, which has "nothing" inside it because we have to stay phenomenally concrete. For Aristotle, such "wholes" are perfectly legitimate because they have existence and properly constituted are actually 'essential,' whereas he does not give the "void" or "nothing" much credence (*Physics* Book 4, 8, 215b13, and surrounding).

the manifold of the qualitative properties of poetry itself. This power set is a kind of combinatoric of "functional coincidence" where each number is taken first by itself, then in all possible pairs, all triples, a single conjunction of all four, and finally all combinations together. While the combinatoric set is similar to stacking causes on top of each other in a diagram, it is more symbolically determinate than the visual diagrams. In set theory, the combinatoric would hold for *any* four discrete objects; for Aristotle's text, it holds of the actual phenomena of all poetic species as selected differently according to each kind of causation. To see this more concretely, let's assign each number to a causal property: say, 1 => Material cause, 2 => Formal cause, 3 => Efficient cause, and 4 => Final cause. Then, let's think of the different combinations as *definitory comparisons and contrasts* (*Topics i*.2. 101a34-101b4, 4. to 9; Irwin 1988: 175ff.) instanced by them and between them: {{M}, {F}, {E}, {Fn}, {M, F}, {M, E}, {M, Fn}, {F, E}, {F, Fn}, {E, Fn}, {M, F, E}, {M, F, Fn}, {M, E, Fn}, {F, E, Fn}, {M, F, E, Fn}} with the entire combinatoric grasping Poetics-Itself and its emergent Species-Themselves as a scientific subject matter. This power set "counts" each cause *separately* yet in multiple different combinations within a numerable sequence.

Nevertheless, Aristotle's discourse on material causation in chapter 1 is itself phenomenally manifold and not to be eliminated through abstraction in a superficial way. The same assessment holds for all the causes where their functional interactions are productive of appropriate "tertiary qualities" we can appreciate (Dewey 1938, pp. 66-71).[53] The concrete

[53] I am appropriating Dewey's (and Santyana's) term 'tertiary qualities' in Dewey's broadest sense of a tertiary quality being experienced as an attitude or disposition that has its own characteristic in its "application to sensations, ideas, images, volitions, etc." as they rest on the premise of Dewey's emergent theory of mind. (Tiles 1988):

phenomenal view is definitely not "neat" enough for set formalization, but is actually significant by indicating a "failure" of mathematizing qualities. (This theme will be addressed further in Scene II.) Still, Aristotle's method allows us to enrich our experience of art in a qualitative way that the set theoretic abstraction offers nothing of. Set theory *and* Aristotle's functional differentiation together, however, could lead to even further qualitative nuance: the set theory gives us a determinate interpretation of the primary functional relations, while the discursive treatment could reflexively return upon their tertiary qualitative manifold to scaffold our identification of more refined differentiations. For example, computationally engaged art could productively and performatively contribute to such a further fineness of aesthetic discrimination.

We now have three levels or scopes of discursive argument tied down in such a way as to comprehensively determine the argumentative coherence of Aristotle's discursive continuity. First, at the holistic level of developing the full discourse through its different stages of science where the stage of species differentiation, we have seen how the argument proceeds sequentially through four different kinds of poetic powers and their phenomena chapter by chapter. Moreover, I have used a set theoretic combinatoric to indicate how the conceptual dynamics of

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> "The primary and the persistent occurrence in the way of experience is a *Res*, an affair, a concern, a moving complex situation in which so-called, primary, secondary and tertiary qualities are indissolubly blended or fused …" (Dewey "What are States of Mind" (*The Middle Works of John Dewey, 1899-1924. Volume 7: 1912-1914*, p. 37.)

Moreover, I am following Gendlin's account, as a neo-pragmatist heavily invested in Dewey's logic, where such third-order qualities have the character of "felt meaning as it functions in cognition" (Gendlin 1997a, ch. 2). Gendlin makes it clear that such qualities are definitely available for individual experiencing, can be "had," in ways that avoid much of the clutter of attempting to definitively characterize each element of cognition as an emotion, or a percept, or an instinct, etc. From Gendlin's perspective, Dewey's concept of "tertiary qualities" as applying to a "completely general account of mental states, covering sensation, idea, image, and volition" heads in this direction without quite having operationally tied down such "felt meaning" as Gendlin does. See also footnote 21.

the argument play out in the shifting relationships of the various kinds of phenomenal selection of each cause in all its possible combinations with the other causal factors. At this level the techniques of a definitory dialectic of different kinds of comparisons and contrasts serves to lay out the different species in well-ordered details *across chapters*. Secondly, we have also seen a micro level of coherence in the almost word by word tracking of the argument given by the well-ordering of the differences of each species in relationship to each other *within each chapter,* as detailed in the above chart of the separate micro sequences of arts in chapters 1 and 2, with each chapter presenting a different combinatoric arrangement with the same basic ranking or ordering with its functional relationships at work.

Thirdly, between these extremes, it is also possible to approach the text at a middle or meso level to identify how the comparisons are actually formulated and carried out for species to species comparisons both within and across the chapters. While I will not go into the details here, I would like to point out how Aristotle often uses a kind of "phenomenal ratio-ing," (*logos*) or putting two or more specialized terms into relationship as already mentioned above in this quote:

> Just as (*hwsper*) (Homer) was in the serious style the poet of poets, standing alone not only through the literary excellence, but also through the dramatic character of his imitations, so too (*outws*) he was the first to outline for us the general forms of Comedy… (4. 1448b34)

The verbal "ratio-ing" can also be presented visually using a more modern notation:

Chapter 2 *Chapter 3*

$$\frac{\text{Homer's serious style (\textit{Iliad})}}{\text{Homer's comic style (\textit{Margites})}} = \frac{\text{dramatic manner in tragedy}}{\text{dramatic manner in comedy}}$$

Such ratio-ing gives each selected property – such as imitating different characters in action and different manners of imitating in presentation – as a local relationship within a chapter. Then extending the ratios into proportions gives different kinds of properties across chapter relationships. My claim is that each chapter also performs a middle level ranging across the different species in that chapter as an extended relationship from species to species with regard to the single kind of differences for that chapter's cause. Those chapter-specific ratios are thereby placed on the primary contrary range for that chapter, e.g., [noble | as we are | base], but are also thereby interrelated with the other primary contraries of the other chapters. We might visualize this complex relationship as a spectral range of a single color such as green

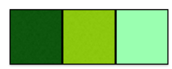

Fig. II-4 Differences in Green Spectrum

as a kind of difference where "green" is present as the hue for all differences in a chapter, but clearly separable as more or less saturation for each shade. These degrees correspond to the varied powers of imitation for the species. And then in a cross-relation to another chapter where

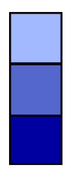

Fig. II-5 Differences in Blue Spectrum

"blue" represents a different contrary range. Taken all together these three levels of reading the text (macro, meso, micro) provide an interpretation that is secure and stable enough to support a coherent extended explication. This interpretation also provides an exemplary instance of what Collingwood (1933) calls a philosophic use of 'overlapping classes' ordered by a 'scale of forms'. Ultimately the modern problem will involve finding ways to integrate the formal precisions of computing and science with such qualitative nuances and discursive connexitivity by means of productive and performative communicative hybrids.

Checking for the precision of "16" implicit in a 4 x 4 model against the text

Returning to Aristotle's text for the test of the model, however, reveals a different combinatoric is at work than the one modelled by a power set of four in abstract set notation. Chapter 1 on material differences identifies only ten species:

> {1} **flute-playing,** {2} **lyre-playing,** {3} **dancer's imitations,** {4} **language alone (nameless),** {5} **mime,** {6} **rhapsody,** {7} **Dithyrambic,** {8} **Nomic,** {9} **Tragedy,** {10} **Comedy**[54]

So our model proves false in its prediction of 16, but "that which is not" is actually helpful here since we've found a structured way to check against the text. One might not even have thought to "count" the number of species mentioned in a chapter. Now we can view "10" in a more structured way as possibly coming from some sort of combinatoric as yet undetermined but already glimpsed. As a combinatoric likely to be available to Aristotle, the number 10 obviously suggests the influence of the *tetractys* and the *decad* relationship. The *tetractys* is both constituted in sequence as an additive sum of 1 + 1 + 1 + 1 = 4, which could represent the sequence of the separate causes one by one, and also as a "combinatoric sum" of 1 + 2 + 3 + 4 = 10, which now seems to match the number of identified species of art. By stressing the literal continuity of Aristotle's scientific discourse against a simple 4 x 4 model of causal crossings, and a set theoretic model of "combinations" as predictions of what the conceptual coherence of using a system of four co-functioning causes might actually be, we have discovered a plausible relationship between Aristotle's mode of organizing phenomena according to causes and its likely historical precursor in the *tetractys*. This relationship gives us an hypothesis for the intellectual history of the emergence of empirical science at least in our "working imagination"

[54] To see each in the text with the Greek term go to Appendix A -- The first 3 chapters of Aristotle's *Poetics* in English with transliterated Greek terms, in the endnotes.

(Richards 1992, p. 42) that we can test again, more rigorously in a later Scene (III). Aristotle's explicit historical account actually makes his scientific narrative less opaque.

But what about the sequential interactions of the group of *six* species stated in sentence 2 which capture poetics-itself as a whole, and that gave us a phenomenal grip on the work that the *four* causal factors perform in the explicit differentiating of them? Clearly, from this "six" and "four," we obtain the identification of the "ten" comprehensive species that the list of six species grounds. We can plausibly claim that differentiation requires the actual functionings of the six species as a basis group for the entire phenomenal manifold to organize their differences and commonalities into the whole of poetics-itself in order for the science to bring that manifold into clarity as a complex whole with several other species. In a recurrent way, this identification brings us back to an implied sixteen of ten sorted-out species that exhibit the complex relationships of the six as a functional manifold. This differentiation matches up better with the two combinatorics of the causal "*tetractys*" operationally yielding ten species, and the teleological completion of the square of the implied sixteen by the figure of the "decad" (moving from figure 1 to figure 2). Teleologically completing the square gives us a 4 x 4 figure that adds up to 16. I cautiously suggest that relying on the six basis species provides a scientific principle for disclosing the whole manifold and simultaneously providing a telic ordering for that whole. Such a simultaneity gives us a plausible sixteen. Nonetheless, it is still one that is implicit rather than actually stated by Aristotle.

Overall, this interpretive intervention provides a bit of corroborating evidence in favor of the hypothesis that Aristotle's empirical science built on the ordering and comparing of the Greek use of the *tetractys*, drawing on this numerological way of grouping diverse phenomena as a previous mode of accounting for nature, albeit a less empirically powerful one. We can learn a great deal about Aristotle's scientific argument through such 'heuristic reconceptualization'. Without a model in hand to refer to, we would not have had any explicit textually given reason to match the ten, difficult to discern, identifiable species differentiated by his text in chapter 1 to the problematic of his inquiry. Serendipitously, our visual metaphor may also serve as a model. If we count the number of causes piled up in the "causal sequence" diagram (figure 1), it too turns out to be ten. When we turn to the "causal combinatoric" diagram (figure 2), the total number of causal coincidences becomes: sixteen. As a result, from tracking Aristotle's procedure of cause by cause differentiation, we obtain both a link to Pythagoras, and an "implicit precision" (Gendlin 2018) of "sixteen." Since it is highly unlikely that we will find any Aristotelian or other text that would explicitly warrant the connection to prior Greek combinatorics, using this procedure of testing a model against the text itself may be one of the few ways of finding out more about Aristotle's science and how it historically advanced over his predecessors.[55] (Section III, below, further investigates a different way to double check against Aristotle's text for some confirmation of his own use of "completing the square.")

<u>Checking for coincidences of causation and the argumentative continuity of the causal sequence</u>

These conceptual and numerical linkages can now be suggestive of Aristotle's transformation of prior notions of causation in the *Metaphysics (A* 5, 985b23-986ab31) into his new mode of doing science – one that he considered better than that of his "lisping" predecessors

[55] Dewey (1938, p. 472) identifies this kind of "likelihood" or mode of probability as:

> … purely qualitative. It cannot be assigned a measured numerical index, even roughly. Its measure is qualitative and is naturally expressed in some such form as "All things considered, it is more likely than not." … "More often than not inferences drawn from this kind of situation … have turned out to be fruitful in spite of absence of adequate material data."

(985a8). Otherwise, the significance of finding a functioning *arithmos* of ten species would pass us by, since there is not any "citation" (as we have come to expect in modern research) of that cultural background anywhere in the *Poetics*. We can see the actual phenomena of the text more clearly through this procedure; it allows us to be more *systematically honest* about what is actually expressed in the text as we thread our way through each significant expression. It gives us a way to return to the text with "fresh eyes" and a questioning mind. It establishes an interpretive dialog with the text that develops a stance of responsibility towards the text by means of one's experience of it through the interpretive process.

Continuing on in the *Poetics'* argument sequence from chapter 1 to chapter 2: when we look to see what remains and what changes with a different causal selection, we observe a suggestive variation in chapter 2. On the one hand, the list of named poetic species is not exactly the same, nor is it in exactly the same order:

> {New art} **Painting** (*grapheis*), {3} **Dancing** (*orchêsei*), {1} **flute playing** (*aulêsei*), {2} **Lyre playing** (*kitharisei*), {4} **Nameless art** (*logous de kai tên psilometrian*), [missing 5 & 6], {7} **Dithyramb** (*dithurambous*), {8} **Nome** (*nomous*), {9} **Tragedy** (*tragôidias*), {10} **Comedy** (*kômôidian*)

[I have retained the chapter 1 enumeration for chapter 1. Painting is added, {5}- mime and {6}-rhapsody are missing in this list, and there are only 9 instead of 10 arts.]

Are these changes simply an inconsistency, or perhaps the listings are more adornment than highly significant? Do these changes signify that the possible origins of Aristotle's '*arithmoi* of phenomena' in Pythagoreanism are no longer plausible? No, the changes arise out of the required shift from the selectivity of material causation (chapter 1) to the selectivity of formal causation (chapter 2). This shift in selectivity can itself be considered an advance over the *tetractys* due to its empirical sensitivity qua kind of cause and its tight focus on a single sort of specialized aspects of the subject matter by means of a specialized contrary [noble | average | base].

Aristotle's setting of the causal differentiations into an ordered sequence that moves through all the four causes gives the procedure a systematic integrity beyond that of Pythagorean numerology.

In chapter 2, Aristotle is focused on exhibiting how the differences in virtue and vice can be noticed, so he revolves the causal selection from the phenomena according to this combinatoric of formal causation in order to give the best examples to notice differences in kinds of character in action. His argument is not tied to a single analysis with a single ordering: it *exceeds* that kind of mono-analytic ordering by moving to a *system of interacting orderings* that yield indications of where their co-functioning leads to emergent properties. This system of interacting orderings is a reason why his grouping of species is not only not a single fixed list: the sequential flow of argument is governed by higher order purposes and systematic scientific procedures that allow great nuance and selective qualitative variation. That qualitative richness would be eliminated by a single list with one structure. Using models and formal language can help reveal such deeper layers of significance, but they will not be able to capture it completely within their formalisms. Instead, tracking his argument requires us to shift our lived apprehensions along with Aristotle's changing selections and purposes as we experience the discursive argument development.

Hence, in the shift from chapters 1 to 2, Aristotle first gives ten explicitly identifiable species of varying degrees of development under selection for the media of imitation, and then in chapter 2, transforms them for a selection of kinds of actions imitated. This kind of flexibility according to kinds of phenomena is intrinsic to the weavings of an empirical cross-species differentiation. It also indicates that Aristotle's particular focus on especially those species that imitate in speech may be less rigid for the whole of poetics that it seems. It is clear, for example, that while Aristotle names "figure and color" as means of imitation in chapter 1, he does not mention the visual arts of painting and sculpture. Yet if somehow visual art were to be developed to be as imitatively powerful as speech, he might reformulate a poetics suited for finding the best arts using color and figure. The fact that the particular number of species are disclosed in the different causal selections seems to indicate that such "counts" do not exhaust the *possibilities* for species differentiation, even for him. For example, in this early part of the *Poetics*, he explicitly refers to dance and painting as modes of art using figure and color but not to sculpture, because in general he takes those species that use speech as intrinsically more imitative, and accordingly does not go down the path of entirely differentiating visual species. After all, dance *is* more dramatic than sculpture. Yet he does mention a statue of Mitys later on at 1452a9, and refers to sculpture in other treatises (e.g., *Met.* 1013b6, *N. Ethics* 1175a31, etc.). Even in the instance of sculpture in the *Poetics* we find a refinement in actions. Aristotle's use of the image of an honored man (*andriás*) is not precisely that of a "standing," a "statue." Rather it is an image of a hero wronged through murder *put into action* to posthumously kill his murderer. It is valuable as a *dramatic incident*. Including a detailed causal differentiation of sculpture is just not important enough when traveling down the path to the three best species using *logos*, two of which are thoroughly dramatic (as found in chapters 1 through 5.) Aristotle's differentiation is clearly limited by his governing aim of narrowing the focus of poetic science to comedy, epic, and tragedy as the best and most imitative in their cathartic function, so going into the details of lesser modes has a much lower priority.

Consequently, my use of the number 16 is better understood as a modern *idealization* of Aristotle's process of differentiation for the purpose of finding a clear and concrete model of it. Models do not have to be physically literal or strictly mathematical in order to be very useful.

Even in modern science: they can be and often are ‘heuristics’. Aristotle’s system of interactive orderings did not necessitate emphasizing a precise number of species in order to complete the given goal of recurrently sifting the species according to their degrees or intensities of imitation in four different but interlocking selections. Indeed, the occurrence of 10 in chapter 1 might even suggest an *arithmos* more closely tied to the *tetractys*. (See Appendix C.)

<u>The 4 x 4 model as an idealization of Aristotle’s scientific method</u>

My modeling idealization should not be confused with anachronistically forcing a modern combinatoric on Aristotle’s text: to do that would be to lose focus on the expressions of the text and the phenomena they signify that are not captured by the model. Aristotle’s system is flexible in its methods in at least two ways. First, his object of concern in the *Poetics* is one of finding an actual range of species under a particular interest in differentiating the best catharses using speech in particular, about serious agents, and presented in dramatic motion. That purpose could have shifted had he wanted to critically account for, say, Phidias’ statue of Zeus at Olympia (435 BCE), which he explicitly refers to in the *N. Ethics* (1141a910) and even assigns wisdom through art to Phidias: “Wisdom in the arts we ascribe to their most finished exponents.” Aristotle’s procedure of differentiation is flexible in that it could be shifted to emphasize the “figure and color” side of artistic media to help pin down its particular excellence. And second, Aristotle’s system is flexible in its methods in the sense that it does not attempt to dogmatically fix a strict number of species independent of his procedure, as their numbers are both artificial and dependent upon the actual works produced by poets, which varies over time. Differentiating the initial six species into roughly ten species was both *adequate* to capturing the causal whole of poetic science, visual and audio, and *sufficient* to characterize a procedural path to a balanced endpoint scale of the three that are its best existing forms, out of all existent modes using *logos*.

On the other hand, the modeling idealization becomes more reasonable for our further inquiries into different *numeracies* precisely because it has an overt structure. We will see this beginning with the first more abstracted model (β) of Aristotle's process of differentiation as developed below. As a first shift in numeracy away from Aristotle's discursive *arithmos*, the model (β) does in fact provide a physically concrete realization of a different way of having *only* 4 distinct physical properties that are grouped together in collections of 4 "game" pieces that together generate arrangements of 16 total, even as it loses some of the qualitative richness of Aristotle's procedural *arithmos*.

<u>Natural language discourse is more powerfully expressive for the arrangement of qualitative phenomena</u>

In contrast to an idealized model, interpretive closeness to the text gives us an assessment of just how densely literal and nuanced Aristotle's argument is. As he straightforwardly states in chapter two's formal differences, the specialized science of poetics achieves its classification through the coordinated co-functioning of poetic causal factors, with the formal as dominant. He lays this out through a procedure that results in a functional scheme, a species "enumeration," as provided by an empirically specific combinatoric differentiation:

> It follows (ἤτοι), therefore, that the agents represented must be either above our own level of goodness, or beneath it, or just such as we are in the same way as, with the painters, the personages of Polygnotus are better than we are, those of Pauson worse, and those of Dionysius just like ourselves. *It is clear that each of the above-mentioned arts will admit of these differences, and that it will become a separate art by representing objects with this point of difference.* (2. 1448a4-9. Bywater trans. Emphasis mine.)

Aristotle is <u>not</u> simply talking *about* the differentiation of species here; the text is actually *performing their differentiation* throughout a continuous argumentative sequence (1447a17-1449b22) according to this general scientific procedure as specialized to poetics. The statement *of* the procedure <u>coincides</u> *with* the performance of it, throughout the causal chapters of the text.

Because of this doubling up of significances[56], it's possible for the structure of the differentiation to be abstractly stated as a model, even if the model idealizes it. In brief, doing so is not entirely unlike how today we might restate a classic verbal statement of a numerical relationship such as Euclid's Greatest Common Divisor procedure (*Elements*. Prop. 1, Bk VII) in a formal programming language. Such a translation would 'reenact' the proof (Collingwood 1946, p. 283) in a modern context.

When coupled with the theory of the genus/species relationships and the species differentiating procedure, i.e., theory and method together, Aristotle's discourse allows him to bring the essential coherence of the *many* of different species into the *one* of a quasi-substantive genus, while his method of systematic causal differentiation provides the basis for distinguishing separable but *functionally overlapping species* out of a phenomenal manifold. *By introducing his system of four causes and the theory of genus/species relations, Aristotle takes Greek* arithmos *beyond the numerology of the Tetractys into an empirical science of phenomenal forms and activities.* As Aristotelian method shifts observation between the various poems and their constitutive causal factors, thereby clarifying the species forms, the *expressive fact* is that the actual discursive process is even more complex as it develops and reshapes itself. Aristotle turns this discursive process into the founding of a genuinely empirical science of phenomena: one that "saves the phenomena."

In Aristotle's corpus, this procedure is not limited to the *Poetics*. It is also at work, either in more terse or more complex applications, in many of his works. In chapters 1-5 of the *De*

[56] Aristotle's doubling up of the discursive functions of *saying* and *doing* in a *continuous* argument development gives us multiple, mutually consistent textual significances to scaffold the interpretive process of systematically posing and testing determinate readings of the text. It provides its own qualitative experience of the text through the process of interpretation.

Anima, for example, the sequence of interactive orderings is considerably more complex as Aristotle simultaneously weaves the definition of life-form <u>into</u> the differentiating procedure rather than defining soul separately after the procedure. The opening chapters of the *De Anima* require this added complexity because of the difficult problem of how to capture the form of something that is essentially to-be-lived, whereas a poem is an artifact. For example, the kinds or species of soul have to be determined in the middle of laying out a definition of soul in book *ii*, chapters 1-5 and especially ch. 2, whereas the kinds or species of poetic artifacts are captured as a whole in sentence 2 of the *Poetics* before differentiation begins. The separable exposition of the different steps in the *Poetics* makes a "pretty good story" (Richards 1972) about the science of the higher-order connectedness and interrelations of the manifold of poetic qualities that simultaneously reveals its scientific methodology in the clearest possible way. It not only does the work of science, but it also does it in a self-exhibiting manner appropriate for artists and critics. An artist might accurately say the *Poetics* is "well spoken" for her purposes of noticing more nuanced artistic differences. I am not aware of anywhere else in Aristotle's corpus where this procedure happens in such a clear and functionally explicit way for an entire science at one go. My claim is that Aristotle puts all of these advances over his predecessors together in the *Poetics* in such a way as to exhibit how they can be sequenced with great clarity in the scientific procedure of species differentiation that then leads to scientific definition and an articulation of their particular functions within a single species, Tragedy.

<u>Aristotle's science uses an empirical method that is</u>
<u>more powerfully concrete than a Platonic *diairesis*</u>

With the above heuristic reconceptualization of Aristotle's method of species differentiation in mind, it is appropriate to suspend the tradition of interpreting this procedure as a Platonic *diairesis* best exemplified by the method of the Eleatic Stranger as he hunts for the sophist in the *Sophist.* (Benardete 1993, 1984) For the sake of neoteric inquiry coming "after" Aristotle's scientific method as such, what would we find if we rethink each of Aristotle's differentiations and also reenact his method of classification as it develops in the argument afresh? In brief, as we've seen in this third interpretive goal, Aristotle determines all the "first things" or causal origins for imitation to be: the means (various media) as material causes, objects (different actions of agents) as formal causes, manners (variety of styles of presentation) as efficient causes, and proper pleasures (possibilities of purposive cathartic resolutions) as final causes, that all together are constitutive of imitative making.[57] Each such "explanatory factor" (Moravcsik 1974, 1975, Hankinson, 1998) provides its own coherent accounting of the *particular qualitative causes,* such as a determinate kind of melody – say, Lydian – played on a kithara, that provides a "material" basis, woven together with different kinds of action – tragic or comic – providing a "formal" basis, etc., for an imitation. Thus, each kind of causal factor (not just the formal) differentiates the substance according to its kind of functioning [material | formal | efficient || final][58] and thereby determines particular species' characters, i.e., in the modern biological sense of "a feature showing group-defining variation." Moreover, all the causes co-function and coincide in the actual individuals – particular works of art – that constitute the

[57] Bywater 1909; Benardete-Davis 2002; Halliwell 1986; Crane, McKeon, Olson, et al. 1952.

[58] I am using a double bar, "||", to indicate the "doubling up" and "turning around" of final causation.

substance: a tragedy has music, speech, action, character, thought and dramatic enactment cathartically at work within it.

This functional account of causal origins is quite different from the traditional interpretations[59] of this differentiation as a Platonic *diairesis* or "division" of poetic species, which tend to diffuse into multiple genealogical trees under a proposed total descent.[60] In contrast, when construed as a combinatoric structure, Aristotle's procedure leads to a fully scientific <u>cross-differentiation</u> that is a deeply <u>qualitative mode of "numeracy"</u>: this

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[59] E.g. 78-80, Alfred Gudeman 1934:108, F. Solmsen 1935, Else 1967, and Golden/Hardison 1982, with help from M. Pabst Battin's review (1974-75). (Johannes Vahlen 1914 (1885) included diagrams of a proposed poetics for comedy in his text and commentary, but not for the differentiations of chapters 1-3 of the *Poetics*).

[60] This is not at all to say that Aristotle discarded *diairesis*. Quite the contrary, he took it very seriously. For example, he clearly states its limitations for differentiation in logical deduction in *P. An. i.* 31 where he argues that "division" actually assumes what it claims to demonstrate by positing dichotomies as necessary prior to an empirical classification that puts a thing strictly into one or the other side when the actual properties might not so cleanly divide. Moreover, as already referenced, Aristotle also effectively transformed "division" into one of the basic methods of science in his *Topics i.* as a "definitory dialectic" of causal comparisons and contrasts and in his scientific practices. Put in terms of the texts that have survived, Aristotle takes the Platonic method of disclosing the complex soul of the eponymous *Sophist* with all its playfulness and apparent contradictions, and makes it into a more scientifically rigorous *topical procedure* for reaching *essential definitions* grounded in terms of empirically essential or primary facts about genus/species relations. Once those facts are captured, the procedure consists of the systematic comparisons and contrasts as laid out in the first book of the *Topics* and adapted to the phenomenal substance of a given science. That is, he takes the dialectical jousting popular in the Academy and turns it into a general method for both determining the "ultimate bases" (*pros tà prõta*, πρὸς τὰ πρῶτα, *Topics.* 2. 101a37) for scientific principles applicable across the sciences, and then using those bases for developing a systematic causal differentiation of different substances according to their particular species phenomena. Accordingly in the *Poetics*, Aristotle further adapts his practices of genus/species differentiation to the nature of imitative making as means, objects, manners and proper pleasures, by specializing it to the range of causal similarities and differences exhibited by the "primary facts" (*tõn proton*, <u>τῶν πρώτων</u>, 1447a12) of the phenomena of poetry. There and in other sciences it becomes a specialized method of genus/species differentiation where the genus and species qualities are left open-ended according to each kind of substance. This transformation of *diairesis* into a scientific method was a foundational advance for scientific discourse.

differentiation involves organizing the coincidence, co-functionality, and combinatoric comparisons and contrasts of the species that allow for multiple interweaved "accountings" within a substantively determined causal system. For Aristotle, constituting a specialized science of the single substance of poetics-itself required grasping the phenomenal manifold for all of the endogenous poetic species. The science of poetics-itself integrates the many of species into the one of genus. Moreover, tracing the argumentative development of the differentiation will also disclose the *multiply causal argument* for why Tragedy is the best and most noble species and therefore central to the *Poetics* as an exemplary species. This emergent co-functioning ranking of the species produces a teleological result, a teleological judgment of human worth *and* aesthetic pleasures more supportive and worthy of good people or citizens. It's a humanizing "twofer," that is, a multiplicity of life enhancing results for fully grasping one argument.

Interpretive Scene III: ***Emergent Fourth Goal: A Delineation of a Sequence of Combinatoric Models of "Species" Differentiation in Two Phases as a Means of Tracing a Range of Different Modes of "Cultural Numeracy"***

This scene has to do with both the use of models in conducting science *and* the use of models or 'heuristic reconceptualizations' in the interpretation of science. The following sequence of models exhibits both of those sides of inquiry through different models of a shared combinatoric structure. On the one hand, the conduct of science depends in substantive part on the conceiving of possible structures of thought and observation as ways to rigorously examine natural behaviors against a conceptual backdrop that allows the scientist to observe nature more closely. I have argued above that Aristotle's '*arithmoi* of phenomena' for the empirical capture of their relationships is a discursive kind of model. In the history of physics, the flat earth model was held to be true for an indefinitely long period of time, and to some dismay is still held by many of today's population. A different model of the cosmos came with an earth centric concept of the heavens and earth. It served as a fundamental principle for Aristotle's science of the cosmos and became mathematically sophisticated under the Ptolemaic calculations for celestial movements. The model shifted again with the Copernican and Keplerian sixteenth century revolutions, and subsequently made mathematically rigorous with Newton and the invention of calculus. It got further revised in Einsteinian times which is now coming into question under notions of dark matter and energy. The point is that both having and changing models can lead to greater knowledge and precision. Alternatively, the close reading of texts intrinsically requires readers to implicitly or explicitly to develop conceptual models of the meanings captured in the texts. Often these interpretive reconceptualizations (Collingwood 1946, 1939) lead to judgments as to the proper meaning of the text and get codified as the doctrines found in the text.

My interpretation of the early chapters of the *Poetics* takes a different approach to the meaning of the text. It shifts attention to the procedural development of the argument through a variety of methods that attempt to surface the underlying concepts at work for conducting the science, thereby disclosing the process of Aristotle's knowing as an understanding. My method of interpretation makes that process explicit by the careful discussion of Aristotle's scientific methods to the point of laying out just how the phenomena observed can be differentiated and then comprehended by Aristotle's conceptual unifications and methods of argument. I take that exegesis as a <u>discursive model</u> of Aristotle's science in this textual selection as the first model, *α*, of Aristotle's science. By "discursive model" I mean the original text under serious interpretation. The discursive model reconceptualizes Aristotle's scientific theory and then reenacts the argument of how Aristotle practices science under those theories. Model *β,* below abstracts the structure of Aristotle's four contraries, each with two qualitiative endpoints, for the causal differentiation of poetic powers as a [2 x 2 x 2 x 2] causal sequence, and entails a serious loss of meaning. Yet this first model, *α*, is still discursively tied to the text and remains within the frame of a philosophy of discourse. It retains the referential richness of "saving the phenomena." Model *α* is the only model in the sequence that arises from the full range of meanings found in the text. The following three models are more focused on the shared [2 x 2 x 2 x 2] structure, and the range of ways this same structure can capture phenomena in an increasingly rigorous mathematical interpretation while also decreasing phenomenal richness. In terms of differing numeracies, the sequence runs: *α*: discursive manifold under interpretation with an indefinite numeracy tied to the rigor of interpretation, *β*: a small finite physical model with 16 discrete "species" possibilities, *γ*: a large finite range of possible winning games, and *δ*: a potentially countably infinite linking of propositions. The properties of the different numeracies involved are the focal concern.

What might these models of the [2 x 2 x 2 x 2] shared structure reveal about Aristotelian science, and what might they contribute to major changes in interpretive stances? My primary claim is that they decrease in the capacity to express teleological significance as they increase in mathematical rigor. The key shift of concern for Aristotle's science lies between models α and β because the second model takes Aristotle's dichotomous measures provided by his contraries with all their richness of reference and reduces those contrary dichotomies into strictly binary oppositions such as [light | dark] or [solid | hollow] as singulars rather than as a range. The point is that the second model based in positions on a game board *retains some definite qualitative reference in the model itself while it makes clear the combinatoric relationships between its four qualitative oppositions.* The other two models further decrease and then eliminate all such phenomenal content.

Since the goal of this scene is to disclose the loss of teleological expressive power as the cost of increasing mathematical and formal precisions, the sequence of four models leaves Aristotle's framework in play, but also discloses how scientific modeling is and undergoes a requirement for a plurality of models *and* a recognition that each model has its own heuristic powers and weaknesses. In fact, we can see that process already at work in Aristotle's appropriation of a Pythagorean numerology into a systematic set of selective disclosures of the different kinds of causal agency in the poets' practices of imitative making. Aristotle's system of four sources of natural causation dramatically increases the rigor of observation in the conduct of empirical science. The endpoint of the sequence is a fully abstracted set of binary oppositions that can no longer be conceived as finite. The sixteen 2-place logical connectives (see ft. III-24) are fully divorced from qualitative phenomena, and in fact exemplify a new kind of mathematically essential numeracy, one that relies on numbers alone for its coherence. The point here is that our global cultures are currently struggling to come to grips with this new kind of countably infinite numeracy, and we need to think about the social and political consequences of that more demanding numeracy.

Ultimately, my claim in Scene IV will be that by further developing the rigor of close readings of discursively excellent texts we can make our cultural resources more robust (Wimsatt 2004b, 2007) for handling the major changes in common sense habitats through the transformed understandings provided by reconfigured entrenchments of culture (Wimsatt 2007). While this sequence starts with an explicit model of Aristotle's argument, it gradually loses its experiential connections to reading that text. In the course of the sequence the models become more and more models of numeracy as they are in play as a range of arithmetic skill sets across a plurality of historical and geographical common sense habitats.

While many dedicated scholars have articulated the scientific insights of the classical Greek thinkers, we have nonetheless come to accept an apparent gulf between ancient and modern science that can obscure just how insightful and technically impressive the classical work still is. Ancient science may even possess discursive excellences we have forgotten. Hence, another important part of this project is to explicitly exhibit Aristotle's scientific concepts and methods in a modern light. After the exegetical fixation of Aristotle's species model applicable to all the species as a 'genus-to-species' structure of science, the fourth, follow-on goal is to thematically interface or bridge between an ancient scientific model grounded in phenomenally higher-order concrete references achieved through extended discourse, *and* a core higher-order formal system of countably infinite modern logic. This fourth objective requires tracing themes of concrete and abstract modes of linguistic reference through the changing contexts of numeracy in differently determined conceptual models or structures that are "formally associative" because they all share the same structure of having 16 entities and a [2 x 2 x 2 x 2] combinatoric expansion, even as they range from implicit precisions to formal mathematical precisions. That shared structure is a common conceptual property that makes it possible to disclose their overlapping and interpenetrating numeracy variations. The intended result, however imperfectly realized, is that we end up with a range of numeracies that can be identified in their common sense habitats or find clear indications of them not being part of daily life activities.

Such disclosure is important because it helps to exhibit and heuristically recover "the dependency structure of skills and knowledge"[1] (Wimsatt, in press, and 2013) of the pathway from ancient *arithmos* numeracy and modern formal system numeracy with its increased capacities for quantitative precisions. The historically recapitulative fact of human experiencing is that these various modes of numeracy are still available to us through acculturation and education and even partially recur in individual ontogenetic development. We have lost a focus on the scaffolding of the phenomenal ordering of qualities long provided by extended argumentative discourse, and no longer know how to connect to that power even as our highly mathematized science and technology are producing manifolds of new qualities of uncertain character. Aristotle's *arithmoi* of phenomena, which have proven inspiring to millennia of poets

[1] "Such dependencies exist everywhere in our culture. They affect what we can learn, what we must learn first, and where we can go from what we have learned so far, as well as what changes we can make in our technologies and institutions and in what order. These are important linkages in seeing order in, and analyzing change in our cultural systems. Similar design principles are integral to biological organisms, which are architectures of modulated and differentiated variations on the theme of cellular organization. Our technologies are even more obviously so organized: dependencies recapitulating their histories exist in the design of our computer software and hardware, as in our other technological systems, where hierarchical modularization and chunking is endemic (Arthur 2009, Wimsatt 2013)." (Wimsatt. In press.)

and thinkers, provide an exemplary case for re-grounding, transforming, and the neoterical application of their deeply entrenched cultural heritage.[2]

A Fundamental Problem of Our Contemporary Purposiveness: The Trade Off between Telic Expressiveness and Formal Precision

Our teleological problem is not that we do not have goals and purposes, or that we are not active or busy enough pursuing our aims. We have a superabundance of all of that in today's hurried life. What we do not have is a widespread understanding of the by and large reductive character of our individual, social, and cultural aims. We primarily seek mechanistic and universalist solutions to the full range of problems we face under a rubric of "command and control," that claims the possibility of resolving such striving "once and for all" under exhaustively formalized scientific and technological programs that are expected to be self-contained pure goods in themselves without any wider sphere of unintended consequences. When these formalized scientific and technological programs work, the results can be very effective despite their unintended consequences. However, as we posit mechanically and reductively closed systems of causation of great power, we do so from a standpoint thought to be completely outside of nature, even while we seek to explain ourselves with the very same formalized systems, through a "view from nowhere." (Nagel 1979, 1986). In that way, we have also effectively eliminated any rich, humanized, and ecologically complex and balanced notions of a full teleological understanding. These are problems generated by unprecedented levels of scientific and technological success.

[2] "In a complementary simplification [to the theories of biological inheritance], however, the developmental acquisition of a cultural element has to be possible and accessible to learners in the relevant audience so that it can be transmitted and employed. If it is to be learnable to the appropriate subjects, this means that it should be easier for us to study and untangle." Ibid.

A key point in this argument, that I cannot overemphasize, is that I am seeking to disclose that the modern increase in formal deductive power produces a vehicle of communication, basically first-order logical systems of inference, that *renders the logical languages themselves incapable of any expressive content beyond that of exacting valid inferences or producing effective computational steps*. But this logical constraint does not at all prevent the inclusion of propositions or computed symbolic manipulations with ethical, political, and/or aesthetic content and import within the formalisms. The imports of the content and agency of such expressions can be immense! Yet, for these formalisms the very "value" of expression as linguistic modes is that they are syntactically well-formed, semantically univocal, and pragmatically mechanical. Such a "value" of expression has become precisely and only that of proof certainty or mechanically-symbolic agency in service of externalized and reductive command and control procedures.

Moreover, any computation of significance is in effect a formal model of what might be a correct meaning for human cognition. Such models can help point out errors in our understanding as well as provide precise symbolizations we might not be able to generate ourselves that are "truer" (Wimsatt 2007) by reason thereof. My intent is to point out the differences in *powers of expressive significance*[3] between extended natural language discourse

[3] Dewey (1938) uses a vocabulary of "significance" to put an emphasis on how experienced meanings are had or lived in actual problematic "situations." This term is closer to Aristotle's ties to phenomena than a vocabulary of "reference," and fits more with Peirce's analysis. As Richard Parmentier remarks:

"For Peirce, semiotic relations are anchored in the linkage between signs as constituents of cognitions and external reality, the character of the world 'whatever you or I or any man or men may think of them to be' (MS 2.96:18). This linkage is not a static relationship, since human knowledge and belief about reality must be acquired through inferential processes in which signs and their objects come into truthful relation: 'The whole effort in investigation is to make our beliefs represent the realities' (MS 379). Reasoning involves coming to believe true representations of reality. It is semiotically mediated in that all thought takes place through the with its access to all the subtle modes of various contextual interrelations, with polyvocal connections, and metapragmatic purposes as might promote a particularized dramatic catharsis, versus those of formal language constructs as carriers of valid inference or symbolic agency in the world that reduce out all such discursive phenomena as merely subjective or "poetic." Executing an algorithm can have profound positive or negative human and biological consequences in the world even while the mathematical content of the algorithm is strictly valid and correct in its calculations, and its performative agency is executed completely mechanically.

The fundamental issue here is that this shift in modes of communication appears to eliminate an internalized teleological organization and activity from the human condition, when in fact it deeply problematizes our responsibilities as human beings to ourselves, others, and the living world as a whole, even while we continue to seek to flourish as living organisms by making and developing the purposes and goals of our activities an external requirement. This shift gives rise to an hithertofore unacknowledged *teleological externality*, that must somehow now be "added on" or "integrated back in" to the technological and scientific "fixes" in which we have so heavily invested. Ultimately, we among other living beings, are the ones that must judge the value of computed output in order to restore the profoundly important teleological significances that science has bracketed. Obvious additional examples of externalities outside our cultural ranges of concern are climate change dependency and ecosystem dependency, both externalities to our socio-political economies that are ignored or minimized in much of current public discourse. By eliminating an organic teleology in favor of Mayr's reduction of all life-forms to only teleomatic physics and chemistry and teleonomic "programs" in our understanding

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medium of signs and it is realistically grounded in that the most perfect representations are those that depict reality so clearly that the semiotic means are not distorting factors." (pp. 19-20) of "consummatory acts" (Sloan 2012, Dewey 1938, pp. 33-35, 176-178.), we hamstring our understandings of ourselves as living organisms with proper purposes and pleasures ensconced in vast and seriously unbalanced ecological and cultural conditioning circumstances. There are simply too many and too complex unintended consequences at multiple levels that we are not dealing with for things to turn out well, which harkens back to Dewey's assessment of modern science and teleology:

> *Instead of science eliminating ends and inquiries controlled by teleological considerations, it has on the contrary, enormously freed and expanded activity and thought in telic matters. …* The same sort of thing holds of the qualities with which common sense is inextricably concerned. *Multitudes of new qualities have been brought into existence by the applications of physical [and now other] science*, and, what is even more important, *our power to bring qualities within actual experience when we so desire, has been intensified almost beyond the possibility of estimate.* (Dewey 1938, pp. 75-79. Italics mine.)

I am here seeking to grasp only one aspect of this large problematic, that of how natural language discourse and formal symbolic systems differ in their resources for a wider, more balanced teleological understanding of the living world and ourselves within it. And to do this with a deeply powerful text from the beginnings of empirical science that exhibits extraordinary powers of expressiveness, Aristotle's *Poetics* as a productive science. Natural language is in fact *naturally occurring* within the range of living things, even as it has co-evolved as a technology of communication with culture and developed powers beyond those of speech alone, long prior to the technologies of writing, printing, and computational symbolizations. Natural languages have capacities for meaningful, embodied connections and import beyond those of formal, artificial languages. A basic goal is to recover and exemplify some of that expressiveness through the exegesis of the *Poetics*. The theme for this is the changes and developments of a sequence of underlying "numeracies" that trace the distance between the different expressivities of natural and artificial languages.

Tracing such themes in the proposed sequence of combinatoric models also makes it possible to exhibit changes in the modes of determining scientific facts[4] as scientists have moved from small finite modes in which numeracy is closely tied to phenomena as directly experienced, to increasingly larger finite modes in which numeracy becomes more and more tied to phenomena as formally theorized. I approach this sequence in two phases separated by their respective presence or absence of teleological phenomena. Only Aristotle's discursive statement, model α, is explicitly teleological. Moreover, only the text-under-rigorous-interpretation by a person experiencing the meanings expressed through interpretation could possibly be fully adequate to the depth of the text. In that sense (α), to "model" the text is to live its meanings through interpretation. All the other models (β, γ, δ) that will be discussed are intrinsically reductive. They can serve to exhibit patterns and forms of relations but only at pain of loss of robust meaningfulness. The fundamental point of the sequence of models is to disclose the gradual loss of robust meaningfulness in favor of an increasingly formal reduction of that richness into abstractions that are more readily manipulable as numeric combinatorics.

The first phase, models α and β, consists of Aristotle's causally ordered treatment, α, for differentiating genres of poetic art in a strictly unfolding discursive statement that explicitly includes final causality (chs. 4 & 5) as part of the differentiation; and model β, in which there exist three compositionally different but equivalent and complete orderings of 16 "species" into rows and columns of pieces having two shared properties while changing which pairs of properties are presented. Since all other arrangements have less paired symmetry, it might plausibly – if only analogically – be considered a harmoniously intrinsic "end" for that "whole of 16 poetic species."

The second phase of the sequence of models consists of the next two models (γ and δ). This phase parallels two discrete shifts to large finite numbers of facts. Model γ begins with the shift from small finite to larger finite combinatorics generated under model testing. Model δ ends the sequence with systems capable of formalizing countably infinite sets of facts among which we look for stable expressions of knowledge. For model γ, the ~35k possible "wins" of four board pieces (in the game Quarto) that share a single quality (such as "Tall") does not

[4] Of course, Fleck's 1935 classic, *Genesis and Development of a Scientific Fact*, offers a welcome background for such inquiry. Scientific "facts" change over time with theory and technique changes.

differentiate such wins as better or worse with regard to shared quality pairs such as tall vs. short. Any single quality will do. Model δ achieves a countably infinite range of possible propositional combinations related by the 16 logical connectives such as AND and OR. Here any connected set of propositions must be only finitely long despite an countable potential. Neither of these models has such a stable and "complete" small finite organization as α and β do, and in effect are no longer expressive of a phenomenally concrete teleological goal. My hypothesis is that such tracings may allow us to grasp some of the limitations of scientific fact-making as their "concrete factual stability" is undermined, because our formal models are simultaneously losing warrants for having captured universal physical laws across the entire range of different sciences, as well as losing intrinsically teleological expressiveness. With that said, this property of reduced expressiveness is already a reasonable abstraction fitting online virtual communities joined by partial groupings of aspects or interests.

In any event, the sequence of four models is related through their shared [2 x 2 x 2 x 2] combinatoric structure. The sequence is tied together through this "formal *associativity*," not by a deductive or set theoretic argument about isomorphism. Moreover, none of these models is a strict subset or superset of the others: they cannot be because the "rules of differentiation" and "mode of species constitution" change for each one. Yet they all share a similar or analogous combinatoric structure as it is transformed from one to another. In that sense of formal associativity, then, they may be taken together to provide insights that bridge the different modes of numeracy and their relationships to qualitative phenomena, ranging between Aristotelian poetic science based in an *arithmos* grounded in qualitative phenomena, and formal predicate logic determinative of truth functional effectiveness with a mechanical mode of symbolic agency.

The four non-infinitary models (α, β, γ, and δ) serve to trace a series of decreasing "argumentative concreteness" and increasing "formal rigor" as marked by the gradual loss of a full capacity to capture a robust qualitative variety of phenomena as an integrated manifold of experience.

Going beyond these four combinatoric models, while further restricting present concerns to the aesthetic, a "third" phase adds two formally infinitary modes of communication, viz. computer programs and predicate logic. Namely, the structures of executing programming statements and of truth functional inference require an explicitly formalized countable infinity for their implicative coherence. They cannot be just finite, large or small. These differences at least allow us to raise purposive issues about the effects of these infinitary modes on contemporary aesthetics: the very real influences of computer programs and predicate logic on culture. I will focus on them through their additions to a Kantian conception of the aesthetics of the sublime with its explicit engagement with the human capacity to conceive infinity as a whole. Perhaps in this way we can turn our very considerations of expressiveness and finality in art as a purposiveness without a strictly defined conceptual purpose (Kant, *COJ*) into a source of insights into our new problems for the humanities as well as our species generally.

How might we begin research into ameliorating our contemporary conditions of narrowly focused means-end goal practices with their explicit, often top-down directed, objectives without sufficient considerations of the wider environments and consequences? For this project, the prerequisite is to first establish Aristotle's text as a model in its own discursive conceptualizations and argumentative development leading to an idealized, yet open-ended, structure of poetic catharsis. Such an open-ended structure of making sense would facilitate individuals and societies in finding their own adjustments through their own narratives and stories, and provide a resolving and more nuanced sensitivity to living and other environmental circumstances that can serve as a phenomenal basis for further generalizations warranted by the cultural grounding in Aristotle. Only with that work in hand, will it even be possible to explore the variations beyond the first two founding and more phenomenally concrete models, α and β, in a later stage of research. For the emergent goals of the project, simply reaching an end point will be more than enough: an end point where questions could be envisioned about modes of producing and organizing technological and scientific facts towards extremely reduced ends. Perhaps at that point we will be able to turn to contemporary art forms to find emergent aesthetic phenomena to work with more explicitly and concretely, thereby tracking the artists and works themselves to help to lead the way – that is, if today's artists were to aim at integrative catharsis in their works. But the responsibility for reconstituting ethical virtues and political justices is much wider, inclusive of a plurality of disciplines and cultures as sources of understanding and wisdom.

Phase 1 of the Exposition of Model Sequences and Significances:
(α) Original Text as Discursive Model, and (β) Physical Model

The first phase, models *α* and *β*, sets the stage for exploring a bridging between ancient and modern science. Model *α* represents Aristotle's causal structure of differentiation of roughly 10 species with an implicitly precise range of 16 species and proto-species at various degrees of maturity and imitative power, classified according to their various combinations of causal elements and presented in discourse as a flexible combinatoric for substantive specialization. Model *β* displays a small finite physical interpretation of that causal structure reduced to an explicit 16 game pieces generated from four qualitative oppositions such as [light | dark]. The second phase, models *γ* and *δ*, may afford a bridging between ancient and modern by constituting an extended sequence of four models of species differentiation with systematic variations open to further elaboration. Model γ offers a larger finite reinterpretation (~35k "winning games") of the same 16 physical piece configurations under a different, weaker notion of species constitution. Model δ shows the system of 16 two-place logical connectives (AND, OR, etc.) as a well-formed mathematical system of relational species for providing truth-preserving linkages between a finite number of declarative propositions in sentential logic. Model δ further serves for the transition to full countably infinite first-order symbolic formalisms including computers. Varieties of concrete and abstract reference can then be traced in either direction as they are transformed step by step through the sequence.

My hypothesis is that such a sequence can provide multi-pathed traversals, or have various methods applied to it, with different "places" (*topoi*) to stop at "along the ways" (*meta hodos*) of further inquiry. Neoteric inquiry might then be able to sally forth by starting at any particular model and traveling to the others, or by taking the entire sequence as a whole in its relationships to wider contexts of study. Braving the different journeys provides retracings of the sequence from new starting points and can produce a variety of "consequences" out of the warrants accrued and their implications when methodologically developed.

With regard to mathematical concepts, and developing a bridge between ancient and modern science, the ancient Greek thinkers were well aware of the difference between commensurable rational numbers and incommensurable real or irrational numbers, *and* the fact that they can be rendered intelligible[5] through theorems such as Pythagoras'; as well as the basic

[5] This is a mathematical commonality behind Kuhn's self-reported insight into how Aristotle's physics was quite reasonable in its own conceptual terms rather than simply bad and mistaken modern science (Kuhn 1987, "What are Scientific Revolutions?" and reprinted in Kuhn 2000: 13–32.).

facts of an endless infinity (*apeiron*) inclusive of rational and irrational numbers. The Greeks were undoubtedly aware of the phenomena of real numbers and the struggle to assimilate them to rationality (e.g., Plato's *Theaetetus*, and Aristotle's struggles with Zeno in the *Physics* and *Metaphysics*), even though they did not have a formal theory of the transfinite that would allow the division of all of number into the countably infinite and the uncountably infinite. Nonetheless they did have powerful grip on a concrete mode of discursive reference that we have yet to linguistically theorize, if that is even possible. As noted in Scene I, the Greeks' numeracy was strongly tied to the *arithmos* (ἀριθμός)[6] mode of reference in which any relationship of things to mathematical forms – arithmetic and geometric – required that an explicit enumeration or geometric figuration that is already given as *concrete, actual things in the world* to be counted or configured, (e.g., *Met*. *Xiv*. 1, 1088b35-1088a14). "3" or "∴" did not mean a particular number in a countably infinite sequence of integers; it meant three *somethings*, three apples, etc. (Heath 1949, Klein 1968; Hopkins 2011; Halper 2015; Stein 1990).

Model α. Aristotle's causal system in the *Poetics* provides a model that is *functionally* complete in sixteen species, as we saw with my proposal that his causal system adapted the *tetractys* into cross combinations of phenomena (Scene I). His causal system captures the full range of possible species phenomena as disclosed by the combinatoric sweep of the causal analysis, even though his argument focuses on those phenomena using speech. Each of the four coincident modes of causation is related to all the others in order to constitute the species differentiation on the basis of species qualities that are shared versus species qualities that are

The truly odd thing about the troubled reception of Kuhn's work on scientific revolutions within philosophy of science conceived as a monoculture has hinged on degrading the terms "incommensurable" and especially "paradigm" into terms of disparagement, rather than enlarging them into a wider mode of intelligibility that discursively bridges across history, cultures, and conditioning circumstances, scientific and otherwise.

[6] Often translated by the word "number."

locally singular. For example, comedy and tragedy share means and manners of imitation, but differ in comedic vs. tragic objects. His scientific terms can readily refer to whole species *and* particular plays as concrete phenomena that both share and differ from other whole species or plays in highly nuanced and robust ways in natural language argumentation. By contrast, for formal symbolic systems to properly formulate this mode of concrete phenomenal reference to our experiencing of poems would require either an extremely complex first-order formalism including definite descriptions and singular terms for particular plays, or a second-order logic. Either way, I assert that Aristotle's natural language argument exceeds the expressiveness of formal logic through its higher-order discursive coherence and its more direct access to experience as substantive.[7] For example, at a lower level of organization, formal logic provides

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[7] See Patrick Suppes (Jan. 5, 2007, Stanford University, http://suppes-brain-lab.stanford.edu/threemeanings.pdf) for one view of how formal logic and computing might incorporate linking of "associative meanings." It rests on the view that:

> "associative meanings, (are) not as widely recognized as (formal definitions of terms in mathematics, and dictionary definitions), but associative meanings are at the center of our cognitive and emotional experience. Baldly stated, the thesis defended is that associations provide the *computational method of computing meaning* as we speak, listen, read or write about our thoughts and feelings." (p. 1, emphasis mine.)

Like Mayr's concept of 'teleonomic consummatory act,' Suppes' 'computed meaning' relies on a relatively uninterpreted concept of a "program" as a fully effective mechanical device as if that were equivalent to Kant's concept of human autonomy. Other thinkers such as Dreyfus, Searle, and Eco (2014, ch. 17) would claim that even Suppes' relatively sensitive awareness of polysemy, context dependence, and actual human cognition is still too optimistic about the 'effectiveness' of formal language symbolizations. One goal in this monograph is to bridge between the natural language and the artificial language modes of creating significance, not to reduce either to the other. This amounts to an entangled merger of "encoding" *and* "entextualization" (Felson and Parmentier 2015, Parmentier 2006, Silverstein 2003, 2004) that can serve to augment them both.

The intriguing and surprising fact is that Mayr's concept of "essence" (and Suppes of "scientific theory" ("What is a Scientific Theory," 1967)) ground their concept in the increased degree of formal encapsulation required for the algorithmic manipulation of signs. This is an entirely legitimate turn towards the precisions and algorithmic control of programs as an "information" model or metaphor for biological research. At root their conceptions depend upon little insight into the myriad varieties of the six functional parts of a tragedy which arise out of the particular causal differences, all in service of a unified tragic plot as experienced directly by the audience. On the other hand, modern science, technology, and formal systems are capable of

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the invention of a new proof technique, that of the 'arithmetization of syntax', which arose out of the 19th century's quest to secure our modern concept of number, including infinitesimals and reals. Dedekind and Cantor developed the basis to the point where Hilbert, Gödel, and Turing could further develop this method into a mathematization of language as *formally mechanical*. ("Arithmetization," Encyclopedia of Mathematics. URLs: https://www.encyclopediaofmath.org//index.php?%2520title=Arithmetization&oldid=31744 , and https://www.encyclopediaofmath.org/index.php/Arithmetization_of_analysis My claim ultimately will be that the modern concept of "essence" as grounded in a higher-order formality is quite different from the one that Aristotle fixes through extended natural language discourse. My basis for the term 'teleological consummatory act' lies in the expressive precisions and powers of natural language. According to Jonathan Lear, Aristotle's logic found its validity through *term variables*

> "which transcend the problem of knowing that particular terms (e.g., 'good', 'pleasure') are genuinely arbitrary and illustrative of a valid inference. He employs both *ekthesis* (ἐκθέσις) and argument by *reductio ad absurdum*.
>
> > 'For if *b* belonged to some *a*, for example to *c*, it will not be true that *a* belongs to no *b*; for *c* is a *b*.' (*An. Pr.* 25a16)
>
> In my opinion *ekthesis* is similar to the use of free variables in modern systems of natural deduction." (Lear 1980, p. 4).

In my analysis, these 'term variables' provide *exhibitions* (*ekthesis*) of particular instances *through natural language* as well as inferences under Aristotle's term logic. Such terms thereby retain their greater power of phenomenal reference with all its concrete qualities while used in Aristotelian syllogisms, even though they also provide an analogy to free variables in formal deduction. Aristotle's wider qualitative referential capacity must be eliminated for the formal enumeration of well-formed symbolic atoms. Formal languages *enumerate* symbols to gain the precision required for *encoding* their algorithmic manipulation by computers according to truth functions. Natural language discourse proceeds through *entextualization* that is *not* mechanical in that sense. It retains a greater access to the multiplicities of significance that a term logic can still "exhibit" even while achieving logical consequence. All of this depends upon the power of discursive argument to marshal significance, including telic significance as found in terms such as "good" and "pleasure," as explicitly used by Aristotle even in the *Prior Analytics*, not on poetic license in the use of language. In brief then, the modern concept of "essence" following Mayr and many others is "mechanical *and* executable," whereas Aristotle's concept of poetic "essence" is "productive *and* performative." We are still working out Kant's insights into how "mechanical" or Newtonian science does not rise to or explain teleology even though Kant himself was not convinced that an intrinsically teleological science of biology was possible (Richards 2002 p. 231).

handling large finite numbers of well-formed entities and infinitary coherences with much more abstract and inferentially powerful models within their system. If we can find a sequence of steps between these endpoints, we might be able to inquire into human continuities across these differences with a much better hold on what was, what has become, and what remains common.

Structurally, Aristotle's method of classification constitutes a system of four contrary ranges of imitative techniques cross-differentiated into a whole system of causal functions according to these four techniques:

Technique I. Poetic tactics making use of [color | figure | voice] (or the more technical version: [rhythm | speech | harmony]) as "means" of imitation;

Technique II. Poetic selections of [base | "average" | noble] "actions of agents" as "objects" of imitation;

Technique III. Poetic modes of storytelling favoring one or more of [narrative | mixed | dramatic] "manners" of embodying imitative presentations; and

Technique IV. A humanly universal and historical inquiry into the Poetic effects of [comedic | epic | tragic] innovations that are proper to their respective imitative pleasures.

This system of imitative techniques gives us a solid basis for understanding the model at work in Aristotle's productive science as discursively expressed. All of this exposition in the *Poetics* has the phenomena of the works of art richly in its perceptual and discursive grasp. (See Appendix A.)

As a reduction to the two endpoints of each of four contrary ranges, this looks like:

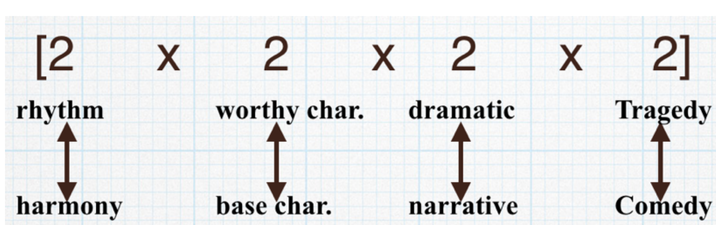

Fig. III-1 Reduction of full range of variants on a contrary to its two endpoints.

Table III-1 Summary Heuristic for the Mode of Numeracy *and* Telic Expressiveness for Model α

Model	**Numeracy**	**Shared Combinatorics**	**Concrete [vs.+][8] Abstract**	**Characteristic of numeric significances**	**Full Nat Lang Expressiveness of Purposiveness or 'Telic Turn'**
α Aristotle's Discursive Argument	*Arithmos* - Greek Small Finite Phenomenal Combinatoric under theory of essential genus/species	**Complex of 4-Causal Contrary Intersections [4x4] for around 10** Actual Poetic Species Phenomena, and an **implicit range of 16**.	Concrete (actually occurring) Greek Modes of Imitation organized by causal differentiation into "species" possibly open to philosophical idealization.	Causally complete organization of multi-faceted & essential poetic phenomena	Strong cathartic function per any complete poetic species in polyvocal terms [*telic value of individual/social integration*]

[8] I am introducing the notation of '[vs.+]' (read as "versus plus") here as an indicator for a *productive form of ambiguity between concepts*, i.e. an ambiguity that leads to further conceptualization and concretization of significances. It is derived from the two modes of linguistic significance at risk in this project – [natural language discourse | formal symbolic logic]. The notation takes Aristotle's centering on "sameness (*homoíon*) and difference (*diaphoràs*)" as the source of substantive content for propaedeutic art of 'comparisons and contrasts' that can lead to definition (*Top. i.* 4-18). The practice of this art underlies all his sciences including poetics and gives rise to composition of extended argumentative discourse. At the opposite extreme, formal logic is grounded in the very possibility of a truth functional coherence of connectives across a potential countable infinity of formal linkages between propositions. Established notation for the two-place connectives of "AND" and "OR" is often symbolized as "$\wedge$" and "$\vee$". Both pairs of connectives are sufficient to establish the appropriate possibilities of discourse and inference, but are not sufficiently determinative for science by themselves. This condition is most clearly evident in the logical connectives of AND and OR, for neither connective nor the pair of them is adequate for the logical closure of all possible two-place connectives. A simple way to achieve that is to add NOT, but there are many others. For dialectical comparisons and contracts, completion requires some system of categories and an idea such as genus-species. The notation '[vs.+]' is intended to symbolize a hybrid mixture of natural language and symbolic language modes of significance between two concepts or terms wherein possibilities for further positive determinations between the terms can be developed. The "versus" part "vs." is a natural language expression, while the "+" part is an explicit mathematical symbol. The two square brackets "[" and "]" indicate that a *commonplace* or *topic* is under development.

The present case of "Concrete [vs.+] Abstract" is meant to be taken as positive cross-determination by the two connected terms, here "Concrete" and "Abstract," in a way that leads to the sorting out of the similarities, differences, and relationships between them. Aristotle lays out

Model β. In order to partially formalize these techniques, the four contrary ranges can be abstracted or idealized into four pairs of two endpoints exhibiting a [2 x 2 x 2 x 2] system of overlapping causal functions, i.e., an implicit system of 16 cross-differentiated species. This move drops the "middle" term (i.e., figure or shape, average or "as we are," mixed narrative and dramatic, excellence in epic as precursor to both tragedy and comedy) of Aristotle's three term contraries, thereby fundamentally simplifying this causal system, especially because Aristotle's middle terms have a way of complexly cross-instancing each other in a causal system as it captures substantive relationships in discourse (*Post. An. I* ch. 29, *II* chs.11,15, & 16).[9] [10] This simplified view of Aristotle's discursive differentiation gives us our second model β, in accord with and subsequent to Aristotle's original discursive account.

Moreover, in keeping with "saving the phenomena," a *physically concrete* second model based on just a [2 x 2 x 2 x 2] system of interactive factors can be found. The physical system of

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a definitory dialectic for this kind of conceptual operation in *Topics i.*2. 101a34-101b4, 4. to 9. I am using it more generally as a way of coalescing a wider field or complex of significances not yet transformed into a settled problem or problems. The connective pairing "Concrete [vs.+] Abstract" is intended to be both prospective and abductive within a problematic situation. It provides a beginning point for further inquiry not as yet resolved into determinate significance with regard to the problem.

[9] Generating a system of coincident, co-functioning causes, [material | formal | efficient | final], is actually one of Aristotle's scientific techniques for finding a conceptual closure of a genus and its species *including a telic end point* that is not only finite, but also resolvative ("consummative") of any potential for a run-on (*apeiron*) series of indefinitely related "things" supposedly of the same kind.

[10] Indeed, his model is also adaptable to a larger number of species by lowering the resolution on some of the factors and increasing that of others. For example, the *Poetics* emphasizes species heavily using speech as a means of imitation while deemphasizing color and figure. Given development of more powerful visual art forms in the city, the emphases could be reversed to more closely differentiate primarily visual species of imitation.

16 wooden game pieces (Quarto ™ [11]) provides us with an even simpler and also a more abstract model instance, while retaining an explicit reference to existing things in the world, i.e., the game pieces with their qualities. We can concretely perceive the qualities of each game piece even as they are now put into an explicit conceptual organization. Each wooden piece exhibits a unique combination of [dark | light], [round | square], [hollow | solid] and [short | tall] properties that have a determinate arrangement as a system of 16 “species” of blocks, which taken together can exhibit a holistic pattern that can be laid out on a 4 x 4 game board. For example, here is a [light | square | hollow | tall] piece:

Fig. III-2 One Quarto game piece with four different qualities

and a completely organized board of 16 species:

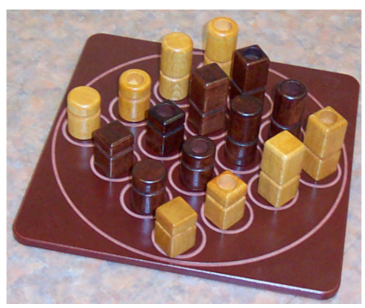

Fig. III-3 Full board with all 16 different combinations of 4 qualities

in which every row and every column exhibits two common qualities together (such as square-and-light) in ways that range through all possible combinations of two qualities.

11 http://www.marblesthebrainstore.com/quarto.htm?gclid=COGQrZaH6NACFYM6gQodqmsNMw

Another fascinating relationship that carries over from Aristotle's science is the literal sameness of exposition across the first three chapters exhibited above between chapters 1 and 2. The holistic pattern of arrangement just mentioned is not unique. There are three different but formally equivalent combinatorics for arranging all 16 pieces into an ordered whole according to which pairs of qualities the process of arranging starts with.[12] It would seem that Aristotle somehow grasped the "threeness" possibilities for different but equivalent combinatoric arrangements underlying this small finite system of species even as he maintained a much more qualitatively rich range of species of imitative making.

Having found and stated a physical model of Aristotle's species differentiation (i.e., the Quarto systems taken as a small finite whole of species variations), we can ask more precisely the question "What is this a model of?" At least initially we can answer that this second model β – taking after the model in discourse itself (model α) – is a <u>model of the relationships</u> of the 16 species of imitative making as real phenomena occurring in the city, and as captured in the natural language conceptual system of Aristotle's scientific terms as presented and argued in his scientific discourse. Model *β* discloses the underlying pattern of selective observation Aristotle used to differentiate, organize, and evaluate poetic species.

But what are those relationships, given their plurality of poetic causal determinations as required to explain each different species? And how can these relationships be stably conceptualized given their multiplicities of genre structures, varieties of genre phenomena, and pluralities of poetic effects? These questions cannot be easily answered in the abstract; their answers require care in stating the relationships as differences in natural language terms fixed through their explanatory insights into actual poetic making. In relation to this concern, an underlying goal of the exegesis is to set up such a more determinate exposition of Aristotle's

[12] See Appendix - D1 for an account of the three determinate arrangements with pictures.

natural language discourse as a phenomenally concrete science, such that it could allow a next stage of research and inquiry.

Table III-2 Summary Heuristic for the Mode of Numeracy *and* Telic Expressiveness for Model β

Model	**Numeracy**	**Shared Combinatorics**	**Concrete [vs.+] Abstract**	**Characteristic of numeric significances**	**Natural Lang. Telic Expressive Decrease. Increasing to Infinite Formal Symbolic Lang.**
β Abstracted 4-Causal System on a whole 4x4 "board"	Small Finite Physically Real Combinatoric	**[2x2x2x2] – 16** Different "pieces" having 1 each of all 4 binary opposites as different "species"	Formal reduction of Aristotle's 4-causal complexity to four binary oppositions such as [Light | Dark] realized in 16 concrete (actual) physical pieces as "species.".	"Simple" qualitative variety in fixed abstract finite form	Complete species organization of board as a whole in 3 ways *[value of multiply organized whole*]

This concept of a model of a system of combinatoric relationships allows us to see back into the formal origins of Aristotle's empirical science as cashed out in Aristotle's scientific procedures in discourse. It does so by giving us a way to abstract away from the phenomenal richness and complexity of poetics-itself as a naturally emergent cultural advance: this cultural advance arose out of the individual, social, and political manifold of exercising a universal human capacity for imitation under necessary and sufficient conditions of surplus that had been attained by the Greek city-states. This cultural advance found a stable formulation for disclosing the relative powers and excellences of the best and most noble species of imitative making. Moreover, ancient Greek culture achieved enough flourishing to allow for the rise of reflective thinking about the very conditions of justice and virtue to the point where philosophizing could critically assess what were the proper pleasures of poetry: at that point, Socrates banished or separated poetry from the City until its excesses could be grasped according to the life-form or "soul" of human nature as a whole in community (*Republic* IX 585a-592b).

Getting this far, it appears that the hermeneutic work for a heuristic reconceptualization of Aristotle's science has paid off in a fresh understanding of his scientific practices, but there is more. Neoterically, the standpoints are reversible. We can also ask the new question of what kind of a model is this system of 16 board pieces, each having a limited qualitative range of 4 different properties? At root we can see that the Quarto pieces and board is a "physical symbol system" (Newell and Simon, 1976) with a *small finite numeracy*. Making the Quarto board and pieces would have been well within the capabilities of the mechanical arts of the ancient Greeks. Nonetheless, it would have had little significance understood as holistic arrangements of the pieces on the board. There would be very little "game" to that: it would have most likely been dismissed as a toy of some sort that had less interest than the Antikythera Mechanism – which we have only recently come to understand as an analog "computer" that gave astronomical information (Freeth 2009). Today we can grasp the import of finding such patterns in much more numerate (large finite) ways through our computer programs, and we currently hope that machine learning will help us do so on a massive data sets of great complexity.

The key point here is the underlying visual precision that countably infinite mathematics makes possible. It allows us to imagine physically realizable arrangements or orderings that are infinitely coherent in their *visual rationality* (Barwise and Etchemendy 1988) and akin to Penrose's infinite tessellations. This full computational precision of physical patterning first concretely emerged in Babbage's ability conceive and mechanically draw plans for his Difference and Analytical Engines that were literally of higher precision than the by the mechanical arts of his time. It is this capacity, this power of combinatoric computing, that enables the discovery of discrete patterns in higher dimensional rationality of machine learning as ways of discovering nature's phenomenal orderings through searching among symbolic patterns in data structures. Aristotle has to achieve logically rational ordering *behind* grammar.

Phase 2 of the Exposition of Model Sequences and Significances:
(γ) Large Finite Game Model, and (δ) Countably Infinite Logical Connective Model

With phase 1 in hand, we may be able to sketch out provisional paths for further research and modeling by systematically varying properties of the two models α and β. The first variation includes “larger finite systems of (poetic) species still with concrete physical interpretations as ‘assemblages’” (Hayles 2017), but with weaker systematicity for intra-species relationships; and the second variation takes a fully formalizing step into a system of logically connective terms with a potentially countable infinite scope of coherence and only a nominalistic instead of a substantive reference to the relationships of concrete (poetic) species phenomena. Both of these emergent models (γ and δ) take us further away from Aristotle’s conceptual and telic closures, and problematize a modern search for new modes of teleologically scientific closure. At this point, all I can claim is that systematically argued natural language discourse is intrinsically more expressive than straightforward statements of doctrine. In a pragmatic sense, I look forward to the possibilities that a wider interpretive field developed for any extended discourse such as Aristotle’s science can afford to the deficiencies and limitations of an author’s own stated positions and understandings in ways beneficial to the community of research into underlying problems.

Model γ. Interestingly enough, we can envision a third model by transforming the very same physical system to produce a much larger finite list of combinations of “less complete species” each constituted by having multiple wooden pieces with a single property such as ‘light’ in a contiguous row on the board. That is, a new system of classification becomes possible by dropping the requirement that a “species” consists of a single entity or wooden piece possessing a complete set of four qualities like the one above: [light | square | hollow | tall], and then reconceiving a “species” as a collection of any four pieces that share a single quality such as “light.” [13]

[13] Many such foursomes can be found in the above Fig. III-3 of the whole board.


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Fig. III-4 Four game pieces with a single shared quality

In this example, the species instance consists of four “light” pieces and also exhibits 2 round, 2 square, 2 short, 2 tall, 2 solid, 2 hollow, and no dark properties. The combinatorically complete system of “four-same” instances has a much larger finite size of around 35,000 possible[14] species instances, with each defined as a winning sequence of four in a row anywhere on the board according to the rules of game play for (Quarto ™).

We are now in a situation that, in formal terms, exceeds the *arithmos* classifications of Greek mathematics and science simply because they did not routinely range up to concretely referring to such large numbers of real things in their calculations (*logistiké*), even though they did conceive of large numbers. This step has genuinely novel possibilities for productions and performances of telic significance because it may provide new “large finite” resolutions not

[14] There is some variability on the exact combinatorics of Quarto owing to different assumptions. Here are two. Just looking at all possible combinations of 4 pieces all sharing one property out of 8 different properties, we see that for each of the combinations of 8 different properties taken 4 at a time we get: Comb(n,r) is Comb(8,4) which equals 8!/(4!(8 – 4)!) = 40329/576 = 70. So holding only “round” as shared for each foursome, there are 70 different ways to combine each four while also having all the other 7 properties vary. For example, here are two of them:

Fig. III-5 Two different combinations of “round” 4 pieces

where the first group of four pieces is [(round, light, tall, solid | round, light, short, solid | round, light, tall, hollow | round, light, short, hollow], and so on for all 70 possible combinations. Holding each of the 8 properties constant in turn, then gives 560 total distinct combinations divided into 8 groups. Secondly, if you include all ways each of them could be placed on the 4 x 4 board, the number is much larger, ~ 35k. Under any of the assumptions the total number of combinations is significantly larger than 16. See Quarto appendix D for visualizations of two of the 8 possible properties, “Round,” and “Square.”

humanly reachable without computer technology. Mathematical recursions can have real consequences in the world; programs can manipulate "things in the world" mechanically, including human cognitions, through a non-conscious kind of cognition we call computing. Yet, similar to the way in which habits are not incompatible with purposiveness, neither are such actual computational manipulations intrinsically incompatible with purposiveness.[15] In fact, we are presently discovering all sorts of possible "bias" in algorithms and programs that need to be addressed (e.g., Porter 2018, O 'Neil 2016, Muller 2018). Oddly enough such computational manipulations are "*immanent* in their employment and when finished are commensurate with the human point of view"[16] (Kant, 1987, *COJ*, § 76, Ak. 403. Pluhar trans.).[17] That is, computed significances may yield physically real effects, but the wider human significances are in no way limited to algorithmic consequences.

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[15] It is my expectation that a rigorous, more than behavioristic, understanding of the discursive codification of "associative thinking" will become very important in the near future.

[16] The full quote is: "What makes it so difficult for our understanding with its concepts to match reason here is merely this: that there is something which for it, as human understanding, is transcendent (i.e., impossible in view of the subjective conditions of its cognition), but which reason nevertheless treats as belonging to the object and turns into a principle. Now in this [kind of case] the following maxim always holds: where cognizing [certain] objects is beyond the ability of our understanding, we must think them in accordance with the subjective conditions for exercising [our] powers, conditions that attach necessarily to our (i.e., human) nature. And if the judgments we make in this way cannot be constitutive principles that determine the character of the object (as is indeed inevitable where the concepts are transcendent), they can still be regulative principles, safe and *immanent* in their employment and commensurate with the human point of view." (Italics mine.)

[17] This is a more philosophic understanding of the commonplace claim that "programs only do what they are programmed to," which is clearly inadequate for understanding the deeper significances of computability, if only because actual programmers seldom know what their programs will actually do. Here then we have the possibility of a new, technologically wider, interpretive stance on Kant's claim that the "*lawfulness of the contingent is called purposiveness*" (§76 Ak 404).

However, unlike Kant's teleological regulative principles, the technologies of computation are not intrinsically "safe" in their application because programs only mediate contingencies: they do not eliminate contingency. Technologies are not neutral precisely because they have impacts *within (immanent to) the purposive* as *technê*, but are *not exhaustive of the purposive for human activities*. With regard to such *mechanical* calculations of significance, and in ways unknown to Kant's understanding of the then burgeoning industrial technologies, computing technologies are yet to be brought within human ethical agency. Moreover, we have now brought the "mechanical" into the calculations of science and society in ways not within humanity's evolved powers to date. We are still very much in need of new ways to make such subsistent cultural influences beneficially concrete in the contingencies of their human impacts. How to take account of finitely large numbers of discrete operations at work all across our daily and long-term activities, as well as how to tune them to real human needs and satisfactions in "organized natural" ways, are emerging as paramount problems across all levels of human behavior, especially as they also readily provide opportunities for exploitation and cruelty. We have not yet brought our practical ability to present moral maxims in order to direct the actions of computational programs to conform to what "ought to be." For example, many of us enjoy the benefits of GPS information while traveling, but we have yet to work out civically beneficial and ethical ways of handling all the privacy issues that arise out of being able to track the micro movements of hundreds of millions of people, or disruption of small communities due to use of GPS to avoid traffic.

All of this innovation from computational technologies generates difficulties, both comedic and tragic, as these high affect problems significantly impact our current human conditions in unforeseen ways. For Aristotle, imitative making produced works of art that were tightly matched with the species constituting the genus of poetics-itself. Contemporary art already produces new roles and situations for agents to explore for resolutions of these highly affect-laden problems that significantly impact our current human conditions – all of which then become phenomena of the city. This sequence of models (α, β, γ, and δ) provides a provisional account of the variety of concrete and abstract modes of reference that artists now have ready to hand. Contemporary artists are already producing works with access to all these possible artistic materials, human actions, poetic techniques, and cathartic ends. The underlying issue is raised in the question: how can we begin to grasp the new varieties of these art works?

Table III-3 Summary Heuristic for the Mode of Numeracy *and* Telic Expressiveness for Model γ

Model	**Numeracy**	**Shared Combinatorics**	**Concrete [vs.+] Abstract**	**Characteristic of numeric significances**	**Natural Lang. Telic Expressive Decrease. Increasing to Infinite Formal Symbolic Lang.**
γ “Quarto™” Game Play on 4x4 board	Large Finite “Game” Combinatoric	**[2x2x2x2] – 16** game pieces taken four at a time with a single shared property as a “species” on different board locations	Retaining the four physical binary oppositions but further abstracting the “species” concept into the single species property of 4 pieces sharing one binary opposite.	Mono-quality aggregates in finitely variable locations	Determinate Exploration of large finite space of weak species concept [*value of same pattern of determinateness for each of 16 qualities*]

Model δ. Stepping up to a fourth, fully modern formal model, a further abstraction of the four two-by-two alternations can be found in the truth table structure of 16, 2-place [true | false] logical connectives, such as NOT, AND, OR, IF-THEN, NAND, etc. These connectives are sufficiently formalized so as to allow a potential countably infinite use of such connectives in a proof or calculation without ever exceeding the use of the 16 connectives. Once again, we have a small, finite collection of 16 "species," now of 2-place connectives between logical terms. Only instead of being unified by the concrete phenomenal essence of imitative making by actual poets in some actual cultural context, the species are formally unified as truth functional with only nominalistic or set-theoretic reference to concrete phenomena. "Causation" here becomes a strictly formal "implicative causation" located in the "satisfaction"[18] of a particular logical symbol system or "effective" execution of a program.

[18] It is important to note the use of such a term as "satisfaction" across artificial and natural language contexts. A significant number of natural language terms have been borrowed by mathematical and scientific thinkers and transformed into technical terms with specialized significances within the respective formalisms. The split between [the Heisenberg "uncertainty principle" as a scientific theory [vs+] more commonplace or otherwise technical uses of "uncertainty"] would be another, more familiar example. "Satisfaction" is one of these terms. Tarski (1969) gives the word a highly technical significance of having a "semantic model" that works in a consistent truth-functional way to provide closures for a formal expression. In a very simplistic example "16" 'satisfies' the equation of 4 X 4 = '16'. Extremely abstract fields of numbers can be construed as 'models' where subtle truth-functional relations might be 'satisfied.' (URL: https://plato.stanford.edu/entries/tarski-truth/.) Such a move takes a common-sense word as well as one with other technical meanings and encapsulates it as a higher-order relational concept in formal logic. We have become accustomed to think of any use with a less technical significance is linguistic dross of some sort. A wiser approach would recognize the duality or plurality of significances in which the use of the word continues with great meaning. Our primary interest is in the kinship of the word 'satisfaction' to 'teleological consummatory acts' and their proper biological and cultural 'satisfactions'. Here then we have a 'situated duality' between two highly significant uses. This duality is a 'hybrid' pair that *mixes* between artificial language constructs and discursively continuous natural language expressions that opens up the possibilities for wider cultural "closures" that do not necessarily privilege the technical use. Doing so is in fact part of our situated problematic. As a pair, it takes on potential agency within the field of our problematic 'situation' brought about by the fact that "*Instead of science eliminating ends and inquiries controlled by teleological considerations, it has on the contrary, enormously freed and expanded activity and thought in telic matters*" (Dewey 1938, p. 78). We need to reframe them in "productively ambiguous" ways. Without doubt, this is a hard problem. Yet such productive pairings can help us navigate and bridge across our gap between ancient and modern modes of numeracy with a restoration of teleological significance. They can help set up a "field of significance" in which the range of term meanings can serve to situate a problematic issue.

Computing does indeed have a capacity for a non-conscious "symbolic agency" because of the mechanical character of symbolic manipulation. Moreover, the symbols' connective combinatorics are potentially infinite in the abstract but not actually infinite in the concrete, which is in conformance with Aristotle's understanding of infinity. In any actual computational context, they must resolve into some explicitly finite set of connections between terms or propositions in order to have determinate significance. In fact, the entire truth functional system exhibits an odd holistic property in that it can be effectively coded to use only a single connective (i.e., either the Sheffer Stroke-NAND or the Peirce Arrow-NOR connective)[19] in different combinations to regenerate all 16 connectives. Each single connective is "complete" in this property (Enderton 1972, p. 51).[20] Therefore, model **δ** exhibits a *constructive* holism[21] at a strictly formal level that provides codes for a vast increase in symbolic precisions in conjunction with many other "well-formed" logical expressions.

One strangely coincident fact here is that the implementation of such formal deductive symbol structures on digital computers merges the higher-order abstractions with actual concrete physical systems – computers – that execute algorithmic procedures by pushing physically real "2-bit" logic gates around (Newell and Simon, 1976). In effect, the number of "board pieces" has

[19] That there are two "complete" connectives, is another, surprisingly formal, instance of an equiprimordial "duality".

[20] Aristotle's system of four, co-functioning kinds of causes also has a certain concrete completeness as it is grounded in the full range of "primary facts" necessary to capture poetic science as a whole, i.e., "beginning first according to nature from the first things," κατὰ φύσιν πρῶτον ἀπὸ τῶν πρώτων, (1. 1447a13. Benardete/Davis trans.). Each of the particular causes, e.g. the material causes of [color | figure | voice] or formal causes of [base character | "as we are" character" | noble character], are also essentially related through their "productive and performative" phenomena.

[21] Such "constructive holisms" in Western culture have a tradition going back to the Greek Atomists, and can be differentiated from "functional holisms" like Aristotle's, and "organic holisms" akin to Plato's and all their progeny since then. (McKeon 1998 (1966)).

increased to the number of logic gates in a particular computer. Turing-theoretic recursive calculations *complete* when they "halt" at a proper endpoint that provides the constructive coherence for the untold numbers of large finite calculations taking place every day around the world. In this model, each such "halt" is analogous to a game win on a much bigger board than Quarto's™. And it is the "… *constructiveness* [that] is the requirement that all mathematical notions be effectively computable; that mathematics be fundamentally reduced to what the Greeks called *logistiké*: to processes of calculation" (Stein 1988) which is what properly constrains computing as a physical possibility.[22] The *potentially* infinite countable operations must resolve at some *definite finite* end for them to solve the well-defined problems set for them, whatever their relations to external realities might happen to be, at whatever level of probability that might include. Accordingly, these "symbolic precisions" become at root '*discrete precisions*'[23] as distinguishable from the '*qualitative robustness*' with its concretely

[22] It is important to note that not all mathematics is constructive and therefore computable. Howard Stein makes a clear indication of this when he surfaces that "the final irony of this story, and the collapse of Hilbert's dream of establishing the consistency of the logic of the *logos* by means restricted to *logistiké,* lies in the discovery by Gödel, Post, Church, and Turing that there is a *general theory* of *logistiké,* and that <u>this theory is nonconstructive</u>; in particular, that neither the notion of consistency nor that of provability is (in general) <u>effective</u>; and further that all sufficiently rich consistent systems fall short of the Kantian "ideal"—are incomplete." (Stein 1988, p. 255. Underlining mine.)

[23] This term is meant to signify the kinds of results of Turing machine calculations that are both meaningful to us as people interpreting the results, and not possible for us to reach directly through embodied human calculations because of their requirements for <u>large finite calculations</u>. For example, a Google search phrase returns results based on extensive calculations about the occurrences of strings that are matched without regard to what the words would mean to us, but rather on physical relationships codified and then manipulated by computers. That they retain human significance and even enhance it, say, by including rankings according to what results other people have found useful, develops their potential for concrete human significance beyond the scale of human communication alone. *We have no other way to have almost real-time access to individual responses of millions of other people. The technology already provides such access to the domains of large finite and yet discrete relationships.* Whether some other technology – such as a future quantum computing or even advanced analog computing - might

experienceable ramifications made accessible in the associative continuity of extended discourse. So, in fact, the entire sequence of four models could indeed maintain a regular variation of modes of concrete reference in different configurations across the span even as they range from qualitative to discrete significances.

Table III-4 Summary Heuristic for the Mode *and* Telic Expressiveness of Numeracy for Model δ

Model	**Numeracy**	**Shared Combinatorics**	**Concrete [vs.+] Abstract**	**Characteristic of numeric significances**	**Natural Lang. Telic Expressive Decrease. Increasing to Infinite Formal Symbolic Lang.**
δ 2-Place Logical Connectives	Small Finite Combinatoric for Indefinitely Large Finite Sentential links.	**[2x2x2x2] – Table of All 16** possible 2-place logical connectives each as a "species" for combining sentences (Enderton Table VI, p. 51.)	Takes finite system of "true/false" truth tables which are physically realizable, to enable larger finite combinations of sentences.	Mathematically closed mappings over enumerable connections between sentences with truth values	Closed table of truth functional connectives for large finite sentential constructs [*value of constructive content*]

We can now review the sequence of four models across this range of modes of concrete reference from qualitative to discrete significances. More specifically in Aristotle's discursive model α, concrete reference is made to the full range of species phenomena qua species and qua individual works of art, with all their experienced variations. The first Quarto model β simplifies that range into just the references to the actual game pieces and qualities as arranged into the

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be used to return the same string matching and would thereby be a different realization of large finite computations or perhaps even more sophisticated modes of encoding is not of direct concern. What is of immediate concern is that we now exist in a culture pervaded by such almost uncanny and *non-humanly realizable computed precisions* that occur within our qualitative experience of their significances. It is surprising how often we experience: "This search result is exactly what I was looking for!" Current computing produces results that acquire human import through a mechanized physical symbol system that for the most part are unavailable to us in alternative ways. We urgently need to understand and purposively respond to what 'discrete precisions' have already introduced into global culture regardless of future computational technologies and their novel modes of symbolic effectiveness. (My thanks to Beckett Sterner for helping to make this point more specific."

whole pattern of a full 4 x 4 board. In this small finite model, each of those pieces in its peculiar collection of 4 properties and the arrangement of all 16 in a pattern is again a concrete reference, but of a more limited and yet more physical character. In the "large finite" Quarto model γ, there is still reference to the individual pieces, only now it takes 4 pieces with the same property to make a "species instance," and all possible species instances can be physically realized on the board as concrete references in a multiplicity of locations. However, the overall space of species instances cannot be realized in a single whole on the board. In a sense, each species instance must be "calculated" during game play to make it exist. Good, intuitive players achieve such "calculations" through their experienced implicit precisions; a computer "player" would have to explicitly calculate them.

The final, potentially countably infinite, model δ might appear to have lost all possible concrete reference in favor of purely abstract definite descriptions for things in the world. That mode of reference would be true of just a self-encapsulated logical formalism. But in the context of a computer realization of a program, we get an odd return of concrete reference in that every formal symbol must in fact be realized as an actual physical sign (arithmetic bits as a "trace" or Peircean "representamen") being manipulated by the program to effectively produce some calculation on a physical basis. This return of concrete reference allows for computers to generate concrete physical actions and presentations that once again become "immanent" to human cognition.

Consequently, at this endpoint of the sequence, we have gained a literally infinite potency for coherent formal reference yielding actual actions and representations, but at the significant cost of losing direct experience fulfilling references to the concrete richness and robust variability of the particular "species" of imitative art in question. For example, take the classic tragic motif of a "play within a play" as already in use in Greek art but as reinvigorated by Shakespeare at the start of modernity. There is no well-formed, formally symbolic expression for the *dramatic effect* such that the tragic plot incidents of a "play within a play" are able to reveal "the conscience of a king," even though this duplicative motif *appears* to be a programmable recursive structure. There is no discovery or recognition (*anagnorisis*) of a hidden agent or motive, and no reversal (*peripeteia*) of fortune allowed in computer languages (e.g., Python or C++), because these functions of plot are higher-order poetic effects dependent on the very ambiguities and indeterminacies of a sequence of actions that fall outside of a mathematical recurrence which must have a single algorithmically guaranteed result. And yet computed agency, with the qualities and consequences it introduces into the world, may again become part of a dramatic structure.

Making Connections between Argumentative Discourse and Formal Logical Deductions

In order to move towards more formalized numeracies, we can compare Aristotle's combinatoric [4 x 4] causal system with the very different combinatoric on 16 in model δ, the last in the sequence to be developed above. Model δ is built on the truth function connectives between two propositions, P and Q, as combined by one of the sixteen 2-place connectives, ${}^{0}C_{15}$, to produce a True or False result: P ${}^{0}C_{15}$ Q => {T, F}.[24] The underlying numeracies between Aristotle's [4 x 4] causal system and the binary truth functional connectives for two propositions

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P	*Q*		F^{0}	NOR^{1}	Xq^{2}	$\neg p^{3}$	$\nrightarrow^{4}$	$\neg q^{5}$	XOR^{6}	$NAND^{7}$		AND^{8}	$XNOR^{9}$	q^{10}	if/then^{11}	p^{12}	then/if^{13}	OR^{14}	T^{15}
T	**T**		F	F	F	F	F	F	F	F		T	T	T	T	T	T	T	T
T	**F**		F	F	F	F	T	T	T	T		F	F	F	F	T	T	T	T
F	**T**		F	F	T	T	F	F	T	T		F	F	T	T	F	F	T	T
F	**F**		F	T	F	T	F	T	F	T		F	T	F	T	F	T	F	T

Table III-5 All 16 possible Truth Functional 2-Place Connectives SOURCE Full table of 16 at: URL: https://en.wikipedia.org/wiki/Truth_table#cite_ref-3 , "Truth Table," Wikipedia.

[2 props. x 2 truth values] are quite different despite their formally shared generation of 16 variants. Aristotle's numeracy is robustly qualitative in discursively handling productive ambiguities in an argumentatively continuous way, while the logical connectives concatenate the truth functional propositions that are literal and univocal steps in deductive inferences. The truth functional "16" is *mathematically closed and abstract*, rather than *causally complete and empirically concrete*. This formalism allows for an indefinitely large, but ultimately finite, connection of declarative propositions into a "true" deduction that carries as much phenomenal reference as truth functional reference permits. Its only finality is that of mathematical closure and the deductive conclusion or symbolically effective action produced. Such a formalized reconception of "discourse" has not been very widely practiced in a strict sense, however our currently preferred "clear" and "fact-centered" modes of communication reflect its influence, even as coherent phenomenal and experiential support for such communications was weakened. Nonetheless, the true influences of this innovation are only being realized beginning with twentieth-century computers that have made a rigorous mode of syntactically well-formed and algorithmically effective program statements possible *and* culturally pervasive.

At junctures of abstract and concrete discourses, one specific problem with this new mode of formal numeracy is that computer programs are fundamentally opaque, even as their qualitative impacts on people and culture are intensifying. In formal logic, what arose as a problem with the "referential opacity"[25] of indefinite singular terms (Quine 1960, §30) becomes

[25] "*Referential transparency*: A property of a function signifying that evaluation of the function with a particular set of arguments always returns the same value, whatever the context in which evaluation takes place. In programming terms this means that the function must not exhibit any side effects, i.e. it must not reference or change variables defined outside the function, except for the variables passed as parameters." "*Side effect*: An effect of a program unit that is not apparent from its parameters, for example altering a nonlocal variable or performing

a massive, culturally profound difficulty with any computer program. In 2015 Google's "total code base was 2 billion lines of code."[26] To say the least, these 2 billion lines of code do not read very well, nor are they enunciated very easily even among programmers (Bolter 1984, p. 125, 127). The reality is that no one programmer or group of programmers understands any significant program in a clearly grasped and consequentially complete way. Computer programs are *teleologically undecided* in their operational significances. To claim that programs will not do anything except what the programmer intends is simply mistaken, and sometimes even dangerous. Computer programs have symbolic agency beyond what humans can command and control in a prior fashion: they intrinsically have unintended consequences and produce emergent qualitative influences for good or ill. That fact requires a posterior, inherently empirical (Newell and Simon 1975)[27], humanistic criticism of computer programs across the full range of human activities from the mundane daily to the globally ethical and political. There is no intrinsic reason why programs must produce humanizing, or for that matter any life-form enhancing, "twofers": if physical nature does not care about life, neither do machines – rather, they must be actively

input/output." "*Referential opacity*: The opposite of referential transparency." Any significant program must use side effects a great deal if only because it handles input/output, and is therefore "referentially opaque" in a theoretical sense. More importantly, the very high complexity of programs makes them massively opaque with regards to output in the practical aspect because of the non-humanly achievable size of large finite calculations. See: "referential transparency," "referential opacity," and "side effect" from: A Dictionary of Computing. Encyclopedia.com. Accessed: 11 Nov. 2017 <http://www.encyclopedia.com>.

[26] Phil Johnson, IT World, September 22, 2015. URL: https://www.itworld.com/article/2985099/application-management/thats-one-big-repository-heres-how-many-lines-of-code-google-has.html

[27] "Computer science is the study of the phenomena surrounding computers. The founders of this society [ACM] understood this very well when they called themselves the Association for Computing Machinery. The machine – not just the hardware, but the programmed, living machine – is the organism we study." (p. 113.) According to N. Katherine Hayles, if the "machine" is an organism, it is a "nonconscious cognitive" one (Hayles 2016, 2017).

designed to do so. Moreover, of course, any design also has associated risks as well as benefits (Buchanan 1992, Norman 1993). Only life cares for itself, and co-instantively for, with, and through, as well as against, other living beings.

Accordingly, a problematic gap remains between these two modes of numeracy as to what happens to concrete phenomenal reference with its concomitant teleological activity when increasingly mathematical formalisms shape reference to be primarily symbolic within the formalisms as such with only nominal external reference. The current Scene II bridges incrementally between these two numeracies in order to exhibit how cultural coherence and teleological functioning within discourse have been gradually forced out of mathematized and mechanistic science. Bridging between these two numeracies proceeds by means of adding another pair of combinatoric models between Aristotle's phenomenal discourse and mathematized discourse. The pair of models in phase 2 shares the same basic structure of factors of 2 producing 16 modes of variation as in phase 1, and yet again differ in their underlying numeracies to provide a sort of formal associativity ranging among all of them.

All four of the models share the same [2x2x2x2] combinatoric structure
while differing in representational expressiveness

Despite their differences in species conceptions, modes of numeracy, and factual determination, <u>in the abstract</u> all four of the models share the same [2 x 2 x 2 x 2] combinatoric structure. That is, the four models cohere formally at a higher level of abstraction in such ways as to open up the possibilities for developing new terms of comparison and contrast across their ranges. In that sense, the different models share a '*formal associativity*' distinct from the associativity of significance intrinsic to extended natural language discourse even though an instance of this form can be found in Aristotle's natural language discourse as well.[28] At the same time, from the standpoint of different modes of numeracy, each different model provides what I call a '*structuring standard*' for the concrete particulars of that mode of numeracy. Each mode of numeracy can be taken to construct or arrange its way of producing significances according to its articulations of the varied abstract and the concrete aspects of the phenomena in question; each mode *gives its pattern or organization to our experience of the underlying phenomena*. In a sense, each one provides its own sort of expressive "interface" for interactively approaching the same phenomena.[29]

In the four models, the different combinations of abstract and concrete generate and structure a different expressive *épistème*. Disclosed in, or designed and directed to humanizing purposes in particular circumstances, each model could scaffold its own "epistemic virtue" (Daston and Galison 2007) as a different mode of cultural numeracy, while at the same time all of the models remain possible in our time in different contexts and spheres of experience. This

[28] Mathematics and otherwise scientific textbooks provide a fascinating modern instance of hybrids of discursive and formal symbolic expressions of their conceptual content, and do not require computing per se. One property of such texts is that they require "thinking outside the text" in the sense that the reader can no longer find full conceptualizations in the discursive parts alone and must turn to cognizing the symbolic formalisms through the reader's own concept formation. No doubt, Euclid's *Elements* with its geometric figures was already on this path. Aristotle's term logic with its letter variables for syllogisms that are then filled in with phenomenally concrete terms remains problematic because it is itself a bridge between extended, ordered discourse and full formalization.

[29] Donald Norman gives several suggestive examples of a range of different person/object interactions as they are determined by the articulation of the different interfaces with the same "object." In a chapter on "the power of representation," he gives an example of how there might be different representations of the same task structure such as "game play" that can make all the difference with regard to their human accessibility and interactive success. In one representation, the "game of 15," the interface is difficult, unclear and rather frustrating, while in another, the game of Tic-Tac-Toe, it is readily accessible, even fun to play. Nonetheless the underlying structure is logically equivalent. Cf. *Things that Make Us Smart: Defending Human Attributes in the Age of the Machine*, pp. 53-55.

plurality remains co-occurrent in humanity even while the historically developing mathematization of culture shifts and alters our dominant modes of framing reality towards a higher-order formal numeracy in contrast to a higher-order concrete *arithmos* numeracy. Being co-occurrent, however, is not the same as adapted and integrated to realize the goals of community.

Returning to Dewey's statement of our modern problematic of lagging in moral and political development, we can make a small step in a different direction for reformulating that problem, as stated by Dewey:

> It is not intimated that the incorporation of scientific conclusions and operations into the common sense attitudes, beliefs and intellectual methods of what is now taken for granted as matters of common sense is as yet complete or coherent. The opposite is the case. In the most important matters the effect of science upon the content and procedures of common sense has been disintegrative. This disintegrative influence is a social, not a logical, fact. But it is the chief reason why it seems so easy, so "natural," to make a sharp division between common sense inquiry and its logic and scientific inquiry and its logic.
>
> [One aspect of disintegration] is the fact, *..., that common sense is concerned with a field that is dominantly qualitative, while science is compelled by its own problems and goals to state its subject-matter in terms of magnitude and other mathematical relations which are non-qualitative. The other fact is that since common sense is concerned, directly and indirectly, with problems of use and enjoyment, it is inherently teleological. Science, ..., has progressed by elimination of "final causes" from every domain with which it is concerned, substituting measured correspondences of change. ...* (Dewey 1938, pp. 75-79. Italics and square brackets mine.)

In effect, we are looking for newly formulated virtues and policies that fit our times with their explosion of new qualities produced by the unprecedented achievements of science and technology, but are confronted with having lost our abilities to form and adopt the manifolds of qualities we now experience and among which we engage our human powers in interaction with on a daily basis. We have immense skills at operating and manipulating these qualities in nature, life, and culture that we spend decades of our lives acquiring through education and practice, if we are lucky enough to have such opportunities. Moreover, we constantly turn these skills into local and specialized 'epistemic virtues' that aim at one form or another of "scientific command and control," and yet have little capacity to turn those skills and practices around into teleologically consummative activities appropriate to the flourishing not only of our individual selves, but also to adapt and integrate the possibilities of personal success into social, political, and cultural policies suited to the apparently unending particularities of life-entire in all those situations across all the levels from individual to global existence.

This problematic is also shared with Alisdair MacIntyre's *After Virtue*, which recognizes twentieth-century scientific and technological achievements as a kind of eristic excellence in which humanity has been reduced to an apparent mass of moves and countermoves for symbolic dominance without the benefits of the higher purposes required for flourishing lives. For MacIntyre, this reduction is a form of "emotivism" that conceals the lack of moral and political integration under the guises of demands for theoretical truth. Yet these theoretical truths fail to capture and properly arrange the "*inherently teleological*" character of life in all its forms. We have placed humanity and becoming fully realized as moral and political beings <u>behind us</u> as we pursue the powers of living in a global situation that is self-conceived *as* "after virtue."

Simply put, the "telic turn-around" I am suggesting constitutes the recognition that our current state of affairs is predominately "before virtue." The astonishing success of all the branches of science has put us into the "state of nature" in a radically new, and rather ironic way. Scientific success has opened up deep opportunities for us to become more fully human in a world of an unprecedented understanding of the complexities of all of nature, a new understanding that shakes the very foundations of Enlightenment political theory as it responded to the emergence of experimental science. At that time humanity seemed ascendant as we gained powers over nature outside of the classical understandings. Today we are finding layer after layer of natural complexity that exceeds what could have been imagined in the seventeenth and eighteenth centuries, and also exceeds our capacities for control through universal laws of nature, even as we find our own natures are opening up to possibilities for manipulation and change that race ahead of what have been stable natural constraints – whether physical or biological. We are facing the possibilities of becoming artificial all the way from language through genetic makeup, where culture and biology are presenting "motions" beyond those captured by Newton and his physicist descendants.

Yet our attitudes in daily life tend to perpetuate our continued belief that we are in a world of "Homo Faber" as opposed to a world of the "continuous automatic process" of daily life and labor (Arendt 1958, ch. IV), much less that of a world where the making of symbols with worldly agency has become symbolically automatic, with consequences we cannot foresee and from which we may not be able to escape. In this symbolically automatic world of agency, "Human the Maker" now has to extend "making" according to models that "illuminate" (*to phanotaton* or *ekphanestaton* (ibid. p. 143)) the emergent qualities of science and technology in our experience of them beyond their instrumentality.[30] This extension of human making is especially needed as the symbolic agencies of computing machines enter (or intrude) into the activities of life-forms themselves, yet fail to secure and stabilize the durability of a sustainable

[30] Arendt places such an experience of something "beyond" its instrumentality and commercialization within the *capacity of a work of art to establish a "durability"* through a "higher order thinking" that has "its chance to be permanently fixed in the recollection of humanity." That is, art has a capacity of "world making" in ways that are denied to the societies of laborers and consumers where commercial "exchange values" dominate. She assimilates "all great philosophy" to such a permanent durability, and also distinguishes such "thought" from "cognition" by allocating the latter to an "intelligence" grounded in the "structure of the brain" which gives us the laws of logic and is mimicked by computers. (Ibid. 160ff).

world culture that can no longer be simply "natural." Arendt poses this conundrum for the human condition of "Animal Laborans":

> For a society of laborers [*animal laborans*], the world of machines has become a substitute for the real world, even though this pseudo world cannot fulfil the most important task of the human artifice, which is to *offer mortals a dwelling place more permanent and more stable than themselves*. (Ibid. p. 152. Italics mine.)

Such computational "acting into nature" of all sorts, including human nature, constitutes definite interventions but does not guarantee predictable consequences and ends. We need to shift our scientific attentions from 'command and control procedures' to *interacting* and *abiding* for the sake of teleologically consummatory acts not just for ourselves, but for the sake of preserving and adjusting to the increasing diversities of all life-forms in manifold ecological relationships before we have massive "colony collapses." In that sense we are in need of a "poetics of science" that includes teleological consummations.

In fact, I assert that there are very real individual, social, and cultural 'reciprocal adaptations' (Dewey 1938, ch. IV) taking place as "cognitions in the wild" (Hutchins 1995) *all the time*, but these adaptations are often beyond our abilities to recognize and accept as qualitative complexes beyond our powers for outright universal command and control. Indeed, these qualitative complexes themselves are changing of their own accord as well as through our interventions. This ongoing change is already clearly the case on the biological level, which as we now know has been true throughout evolution independent of our knowledge of it. In common sense terms, we can frequently see this ongoing adaptational change as ideas and techniques capture formal structures via an associativity that crosses silos of expertise as well as different communities, and then become adapted to new situations and new purposes. That much has often been observed and noted as a phenomenon labelled "technology transfer," but not as often critically examined as problematic within the emergent teleological issues of modern cultures in all their value diversities.

By hypothesis, such cognitions would be ‘formally associative’ exchanges between different lived situations at a “heuristic level” that is above the “meme” level and below the level of formal theory. At such a heuristic level, such formally associative exchanges might be turned to facilitate giving new structures and patterns of behavior to the exchanges of memes and theoretical presuppositions, with unforeseen and unintended consequences over time. In effect, the heuristically conceived virtues and policies would have to be procedurally reinvented and adapted for each situated transfer of virtues and policy conventions. The obviousness of the memes is often too simplistic for teleological traction, and the obscured or opaque acquisitions of theoretical presuppositions are often too hidden, and sometimes intentionally obscured, for explicit cultural examination and productive discussion. Requiring a great deal more attention for our times, this crucial and very problematic context of exchange is between ‘common sense’ and ‘science/technology’ (Wimsatt 2013, 2010; Wimsatt & Griesemer 2007). Our present state of ‘reciprocal adaptation’ across those lived situations is all too evidently disrupted as the rate of exchange has jumped exponentially in the age of computing. We are in need of new epistemics *of* multiplicities of virtue and policy organized into freshly conceived *arithmoi* of the phenomena of culturally situated complexes of tertiary qualities ranging across all the dimensions of our global community.

We can at least begin concretizing the span between higher-order discursive continuity and higher-order formal languages by minimally exploring the range of ‘formal associativity’ and varied standards of expressiveness among the models (α, β, γ, and δ). We can do this by observing that our sequence of four models has two different holisms at its endpoints: one (model α), a higher-order natural language discourse with its powers of concrete reference and intra-discursive cross-referencing made possible through "continuous" argument with its narratively structured "higher index of reality" (R. Richards 1992); the other (model δ), a higher-order formal abstraction implemented on a physically literal machine of indefinitely large finite and strictly constructive capacity as grounded in countable infinity. The latter provides a powerful increase in symbolic precisions as a form of numeracy which I have labeled 'discrete precision' that makes use of large finite collections of terms and relations. We can now keep strict control over large finite entities – such as the DNA of a genome – without loss of effective symbolic control. In contrast, the 'qualitative precision' of natural language discourse provides a robust and highly nuanced access to the intrinsic pluralities of experience that are very difficult, if not impossible to fully formalize and require explicit hermeneutic unpacking.

Together in various sequences, the four models (α, β, γ, and δ) provide a new framework or matrix of a plurality of different modes for comparisons and contrasts ranging from the deeply qualitative in natural language discourse, to the large finite numbers of first-order facts in truth-functional symbol systems. Taken together instead of treating them as diremptive, they can provide potentially fruitful mixing to create hybrids of what is communicable and what is computable.[31] The philosophic work required to produce such hybrids will require the development and application of new *philosophic terms* and *distinctions* developed into *extended discourses* that capture our current and emerging transformations of science, culture, and art,

[31] See N. Katherine Hayles, "Traumas of Code," 2006 for one mode of critical engagement along these lines that deals with specific works of art that explicitly thematize computing as imaginative realities within their plots, which is actually the poetic opposite of computing a tragedy.

including computing artifacts, according to our changing purposes and ethical criteria.[32] Yet even such needed neoteric efforts will have to be grounded in the prior terms and expressive achievements of humankind, both relatively recent and as deeply historic. Intrinsically required, such historical depth is "generatively entrenched" (Wimsatt 2007) for hybrids of communication and computation, in a similar way to how "old DNA" is still part of evolution, to provide a real stability for and adequate insight into the continuing and evolving problems of the human condition.

One small step for humanity …

There are yet two further steps in model building that complicate every step taken so far because they represent truly original cultural advances: the determination of countably infinite formal symbol systems with inference procedures, and the development of countably coherent recursive functions into mechanistic computational technologies. This pair really consists of two closely related elephants, Countably Formal Theory *and* Countably Effective Practice, in the Hall of Language and Culture that everyone is attempting to live or work around by either narrowing to particular aspects of them or denying their presence.[33] These two mathematical advances do not fit our conveniently shared [2 x 2 x 2 x 2] combinatoric structure as they both assume a mathematically required infinitary formalization. That is, in the order of exposition

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[32] A promising example of ongoing work in this arena can be found in the recently announced Digital Ethics Lab at the Oxford Internet Institute of the University of Oxford. http://digitalethicslab.oii.ox.ac.uk/.

[33] Think of taking a higher-order frame where the undiscussed elephant "in a room" consists of "people blinded by expertise" as they study the incompletely discussed elephant. For a humorous comparison from the formal language tradition, see Brian Wildsmith's visually analytic *Cat on the Mat* (Oxford: Oxford University Press,1982, pp. 10-11) where elephant, et al. are on the mat with the cat. Not only does everyone except the cat disappear, the "second elephant" isn't even acknowledged.

rather than that of advances in formal theory, the steps of moving to computer programs and a full predicate logic with equality cannot be properly formulated without assuming an adequate theory of countable infinity. The characteristics of these two new models are included in the combined table of all the Heuristic of Transformations given later.

Table III-6 Summary Heuristic of Countably Infinite Formal Symbol Systems

Computer Programs	Large Finite Halting (Must finish computation)	*Requires Countably Infinite Theory*, but must have finite physical completion	Concrete Physical Realization of Turing Machines doing finite calculations including logical connectives.	"Discrete symbolic precisions" of recursively calculated outputs	Well-formed & effective programs with algorithmic agency [value of *mechanically-symbolic agency*]
Full Predicate Logic Symbolizations	*Theoretically Countably Infinite.* However, all actual deductions must be finite.	No largest Integer. ("For every natural number *n*, *Successor*(*n*) is a natural number" – Peano Axiom 6)	Abstract Symbolic Systems of Inference that can be determined in a finite number of logical steps in formal language expression.	Mathematically essential truths expressed within symbolic formalisms	Truth-functional deductions limited to expressiveness of univocal terms [*value of proof certainty*]

In contrast to the other four models (α, β, γ, and δ), there is no single finite combinatoric for either computer programs or predicate logic. These cultural steps introduce the necessary restriction of symbolizations to being fully univocal: that is, "effective" or "inferential" terms that must be strictly singular in their computational and formal significance.[34] This achievement

[34] One salient recognition of this "infinitary gap" is given by Alasdair Macintyre with regard to the radical differences between a fully coherent discursive argument versus the powers of a fully truth-functional predicate logic in his discussion of the possibilities of universal law-like predictions for social science. With regard to the problem of the impossibility of predicting future human actions and events such as conceptual innovation, unforeseen consequences of as yet unmade decisions, the limitation of a game theoretic understanding of life, and an ineliminable contingency, Macintyre argues:

depends on a radically higher-order concept of number that was first explicitly conceptualized by Dedekind as "cuts to the number line" and Cantor as "orders of infinity" with their advances in understanding the properties of infinity, and then was transformed into a new more rigorous system of logic by such original thinkers as Frege, Peirce, Russell and Whitehead, and Husserl, often to the great dismay of humanists such as Collingwood who experience this innovation as draining discourse of its full polyvocal powers of significance.

As pointed out before, I am seeking to disclose that the increase in formal deductive power produces a <u>vehicle of communication</u>, basically first-order logical systems of inference, that *renders the logical languages themselves incapable of any expressive content beyond that of exacting valid inferences or producing effective computational steps*. Now, in this infinitary context, I am pointing to the differences in powers of significance between extended natural language discourse with its access to all the subtle modes of significance and polyvocal connections as might promote a dramatic catharsis, versus those of formal language constructs as carriers of valid inference or symbolic agency in the world. Executing an algorithm can have profound positive or negative human consequences in the world even while the mathematical content of the algorithm is strictly valid and correct in its calculations. The four non-infinitary models (α, β, γ, and δ) serve to trace a series of decreasing "discursiveness" and increasing

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"In *Philosophy* there are in fact very few and perhaps no valid logical impossibility or *reductio ad absurdum* proofs. The reason for this is that to produce such a proof we need to be able to map the relevant parts of our discourse on to a formal calculus in such a way as to enable us to move from a given formula '*q*' to a consequence of the form *'p.~p"* and then as a further consequence of '~*q*'. <u>But the kind of clarity that is required to formalize our discourse in this way is characteristically precisely what eludes us in areas where philosophical problems arise</u>. Hence what are treated as *reductio ad absurdum* proofs are often arguments of quite another time." (1981, p. 101, and surrounding from 93 to 102. Italics Macintyre; underlining mine.)

"formal rigor" as marked by the gradual loss of a full capacity to capture a robust variety of qualitative phenomena as an integrated manifold of experience.[35]

These formal linguistic advances are grounded in the strange property of countable infinity that allows, say, all the even numbers (2, 4, 6, …) taken together in infinite sequence as being equinumerous with the counting numbers (1, 2, 3, …).[36] Both sequences are "countably large," either one can be used to one-to-one count the other, and in that general sense they are "recursively enumerable."[37] The infinitely many natural numbers are fully capable of counting

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[35] The shift towards eliminating discursiveness was entirely intentional as part of the historic pursuit of rigor in mathematical concepts. One path was to eliminate visual diagrams from proofs through the widespread "arithmetization" of mathematics. As Christian Felix Klein reports:

> Of course even [the shift to use of quantities in calculus proofs] assigns no absolute standard of exactness; we can introduce further refinements if still stricter limitations are placed on the association of the quantities. This is exemplified in Kronecker's refusal to employ irrational numbers, and the consequent reduction of mathematics to relations between whole numbers only; and in another way in the efforts made to introduce symbols for the different logical processes, *in order to get rid of the association of ideas, and the lack of accuracy which creeps in unnoticed, and therefore is not allowed for, when ordinary language is used.* (Klein 1895, Eng. 1896. Italics mine.)

Klein continues on to introduce the phrase "the arithmetizing of mathematics" for this whole tendency toward exactness. What gets lost here is the understanding of the expressive powers of such "associations of ideas" in argumentative natural language discourse. An interesting fact here is that computers are not capable of expressing irrational numbers. All their calculations must be reducible to integer or rational algorithms that are in continual threat of combinatoric explosions and numerical or computational instabilities when "exact" calculations are subverted by accumulated small errors such as round offs.

[36] The following sketch of significant aspects in the development of formal logic is not intended to be a rigorous mathematical exposition, but rather to bring some of the underlying conceptual motivations driving the development of formal systems to the fore. There are many such rigorous accounts, and I point to a few along the way.

[37] There are many distinctions and subtle differentiations involved in these concepts that are not of immediate relevance here. I am simply stating that there is a one-to-one function such that if x is a member of the set of all even numbers, then the function of f(x/2) can be used to count all the natural numbers, and vice versa for: $y \in$ {counting numbers}, and f(2y) counts the evens. Some initial indication of the subtleties can be found at:

themselves and the fractions or rational numbers, but not the real numbers.[38] Formal logic depends on being able to keep track of its own countably many terms and expressions from *within its own formalism*. For this further step, we have a certain fusion of the concreteness of the numeric phenomena *into* the self-encapsulating forms of the symbol systems. Formal "truth" functions entirely within such systems, and yet breaks down at even the tiniest of symbolic gaps. Put paradoxically, such systems achieve a "concreteness of abstractions." This symbolic concreteness is largely brought about by the "arithmetization of syntax" which "codes" syntactic atoms or logical terms as just other natural numbers out of the infinity of natural numbers. It codes them with the more than enough "Gödel numbers" to avoid conflicts or contradictions in a finite proof.[39] The Gödel integers are made to be sufficiently large so as to always stay ahead of the *finitely* many terms of any proof or program that are being counted. This procedure just turns the strange property of countable equinumerosity into a Zeno-like race between the logical terms and their arithmetizing Gödel codes. The finite logical proof or halting computer calculation always ends before it catches up to its codes. This technique of arithmetization is required for both the incompleteness proof of first-order logic, and the theory of universal computability with Turing machines as well as their equivalent Chomsky re-writing systems. These countably infinite structures exemplify the higher-order countable formalizations of mathematics as new

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https://en.wikipedia.org/wiki/Countable_set and https://en.wikipedia.org/wiki/Recursively_enumerable_set.

[38] This is not true for the real or irrational numbers, because, even though the real numbers are also equinumerous with themselves, they are not countable because there are so many of them one "runs out of integers" for counting them. Cantor's diagonal argument proved that even the systematic attempt to count the reals can be used to generate real numbers that escape being counted. There are not enough counting numbers to finish the job. See https://en.wikipedia.org/wiki/Cantor%27s_diagonal_argument.

[39] See Peter Smith's *An Introduction to Gödel's Theorems*, 2nd Ed. 2013, ch. 19 for a relatively approachable exposition of this concept.

kinds of dynamic symbolic inference structures. These formalizations have this built-in "advance guard" of calculations, so to speak, running ahead of the algorithmic calculation. Accordingly, logical terms and their arithmetizing Gödel codes constitute a new mode of literal symbolic conceptualization previously unavailable.[40]

With regard to this new mode of conceptualization, our further step beyond the first four models (α, β, γ, and δ) is a more comprehensive counterpart or "endpoint" to the powers of Aristotle's fully discursive science of poetics. First-order formal systems are fully countable in their capacities to capture relationships that by definition require a fully countable infinity for their realization. The strictly countable rational number system also gives an index as to how there are infinitely many points between any two points on the number line such as the determination of a model for "dense linear orders."[41] This formal recursive achievement is a genuinely different and robust counterpoint to the power to entextualize qualitative nuances found in extended discursive argument than that of the three finite combinatoric models (β, γ, δ). Such formal recursive achievement is robust in the sense of its capacity to generate a manifold of formal symbolisms with quantification that maintain finite truth functionality.

If we again consider Aristotle's argumentative discourse as the other proper and discursively robust endpoint as distinct from the text itself taken as model *α*, we get a four-point

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[40] See E. Cassirer 1929 (1957), Part III, esp. ch. 4, "The Object of Mathematics", pp. 357ff. for an early account of these developments before Gödel and Turing.

[41] Such orderings give an index to how there are infinitely many points between any two points on the number line. "In mathematics, a partial order or total order "$<$" on a set X is said to be **dense** if, for all x and y in X for which $x < y$, there is a z in X such that $x < z < y$." For example, the natural numbers are <u>not</u> dense in this sense because there is no integer z between $4 < z < 5$, while the rational numbers are. Furthermore "density" is not yet fully "continuous," which requires moving to non-countable infinity (Wikipedia: "dense order"). Also see Quine's countable "infinity schema" (Quine, 1982, p. 215).

sequence (*α, β, γ, δ*) bracketed by two manifoldly more encompassing endpoints, i.e., argumentative discourse in general and countable infinity, giving us six positions in all for the range. For the particular instance of discursive argument given in *Poetics* 1-6, we can now characterize Aristotle's science as being a certain <u>fusion of the forms of essential definition *into* the concreteness of the phenomena in ways that exhibit those *phenomena* "for themselves as they are" through a mode of *arithmos* reference</u> in specialized scientific discourses. In Aristotle's science, such naturally "first" phenomena (*phúsin prôtôn apò tôn prôtôn,* φύσιν πρῶτον ἀπὸ τῶν πρώτων, 1447a14) exhibit sufficient emergent phenomena so that what emerges on the way up to first principles as "essential" can stand for the exhibition of the whole of that kind of phenomena. For example, the intricacies of plot with its architectonic relation to all six parts of tragedy – including its own inner parts of reversals and discoveries – can stand for the whole of the species of tragedy by coinciding with it.

Again, putting the point paradoxically, such essentialist discursive argument achieves an abstraction of the qualitative concreteness of the phenomena in the very presentation of the *formal coincidences* of the phenomena themselves. Such organizations of concreteness are how Aristotle's sciences in general "save the appearances"; that is, by turning to "experience to provide the principles of any subject" (*A. Pr. i.* 30, 46a17ff), as he does in Greek sentence 2 and following, in the *Poetics*. As Aristotle remarks in the *N. Ethics*, his productive science of poetics is one of those "other cases [where] we must set down the *phainomena* and begin by considering the difficulties, and so go on to vindicate if possible all the common conceptions about these states of mind, or at any rate most of them and the most important" (*EN vii.* 1. 1145b2-6; as quoted in Owen 1961).

The science of this method is precisely the bringing of the phenomena of poetry as manifest in the city into the performatively essential relations disclosed by the idea of genus/species differentiation grounded in the primary facts (*tôn prôtôn*), so as to exhibit or show forth the real causes or sources of all the given phenomena *as originating from the "specific" central phenomena functioning to give form and existence to the whole of the given species as found in experience*. That procedure is what we see taking place in the scientific definition of Tragedy in chapter 6 as completing one scientific task among a constitutive sequence of specializing scientific procedures: the definitory dialectic (*Topics i*.2. 101a34-101b4, 4. to 9; Irwin 1988: 175ff.) of species differentiation. The poetic means "in which," objects "of which," manners "in what way," and proper pleasures "for the sake of which" of Tragedy are formally determined in that definition (6. 1449b24-32). Fortunately, we already have Aristotle's *Poetics* to consider those difficulties in a sequence that includes differentiating the phenomena of poetic species, characterizing the catharsis of tragic plots, and then laying out a productive synthesis for Tragedy, thereby instantiating this scientific method for Greek imitative making (*mimêsis poíêsis*).

From these contrasts between extended natural discourse and formal language symbolizations, then, it's clear that we have two rather different conceptions of "form": one sense of form as higher order qualitative-discursive, the other as higher order quantitative-symbolic. These senses of form are two very different conceptions of "essence." Neither subsumes the other, nor necessarily excludes the other owing to the bridge or interface of models providing formal associativity, while both have distinctive and very productive powers of expression that are currently deeply entwined in generating new polyadic cultural forms including science, even though disciplinary boundaries continue to obscure this fact. These two potentially co-occurrent standards of “essence” can be productively brought together into a synthetic duality of cultural hybrids characterized by meeting two different pairs of criteria to some degree: the mathematical criteria of “well-formed and effective symbol systems” in a neoteric dialectical comparison and contrast with the phenomenal criteria of “explicit and concrete treatments in discursive arguments.”

At the quantitative-symbolic endpoint, the newly concretized formal systems still pose deep problems for a theory of aesthetics, since these concretized formal systems require an explicit <u>conceptual closure</u> that is not there in either Aristotle’s beautiful/noble (*kalos*) catharsis or Kant’s aesthetic judgments of the beautiful as symbolic of the good. In fact, it is precisely the poetic rather than philosophic character of plot for Aristotle, and the purposiveness without a purpose of beauty for Kant, that give catharsis and aesthetic liking (respectively) their powers to shape experience and community in preconceptually leading and potentially telic consummatory ways. Moreover, for these concretized formal systems, there is the deep problem of what can the expressive character of such art be in the face of such hybridized “concrete abstractions.” Both Aristotle and Kant frame the aesthetics of beautiful art as not being reducible to concepts alone, and yet this new mode of symbolization is in a sense “pure concept.” Its very mode of “concreteness-in-abstraction” is a new phenomenon that is already and will continue to be played out in contemporary art and society.

Can such abstractly concrete art be reduced to formal symbol systems or relaxations thereof as Nelson Goodman (1976) argued for? Or might it rather be the case that such forms themselves must be appropriated into productively crossbred works of art as artists seek new ways to understand and portray our contemporary human experiences, which now include socially pervasive interaction with them through computer technology? What new modes of poetic synthesis will emerge and develop? How can humanity in all the "fragility of its goodness" (Nussbaum 1986) take responsibility for itself through a teleology of consummative acts expressed in such art? These are still very much open questions, since as yet our culture has not evolved to the point of comprehending the human significances of such constructive mathematical expressions for the beautiful. I will not be tackling these broader aesthetic problems here, although I would like to believe I have developed a humanistically constructive path to them: one that brings the variously concrete modes of experiencing numeracy along with it up to the point of higher-order formalization in conjunction with higher-order phenomenal functioning, through the consequent hybrid duality of standards of excellence.

Returning to the sequence of four models, the complications of the two further steps in mathematizing can be combined with it as a formal endpoint. The following Summary Heuristic of Modes of Numeracy *and* Telic Expressiveness pulls together the four model determinations starting with Aristotle's extended natural language argument and ending with the additions for "Computer Programs," and "Full Predicate Logic Symbolizations":

Table III-7 Comprehensive Heuristic of the Transformations between Modes of Numeracy *and* Telic Expressiveness from Aristotle's Discourse to Predicate Logic Symbolizations

Model	Numeracy	Shared Combinatorics	Concrete [vs.+] Abstract	Characteristic of numeric significances	Decreasing Nat Lang Telic Expressive Increasing to Formal Lang. Precisions
PHASE 1: Small Finite ***α Aristotle's Discursive Argument***	*Arithmos* - Greek Small Finite Phenomenal Combinatoric under theory of essential genus/species	**Complex of 4-Causal Contrary Intersections [4x4] for around 10** Actual Poetic Species Phenomena, and an **implicit range of 16**.	Concrete (actually occurring) Greek Modes of Imitation organized by causal differentiation into "species" possibly open to philosophical idealization.	Causally complete organization of multi-faceted & essential poetic phenomena	Strong cathartic function per any complete poetic species in polyvocal terms [*telic value of individual/social integration*]
β Abstracted 4-Causal System on a whole 4x4 "board"	Small Finite Physically Real Combinatoric with fixed qualities	**[2x2x2x2] – 16** Different "pieces" having 1 each of all 4 binary opposites as different "species"	Formal reduction of Aristotle's 4-causal complexity to four binary oppositions such as [Light | Dark] realized in 16 concrete (actual) physical pieces as "species."	"Simple" qualitative variety in fixed abstract finite form	Complete species organization of board as a whole in 3 ways *[telic value of multiply organized whole*]
PHASE 2: Large Finite ***γ "Quarto™" Game Play on 4x4 board***	Large Finite "Game" Combinatoric with qualitative equivalence	**[2x2x2x2] – 16** game pieces taken four at a time with a single shared property as a "species" on different board locations	Retaining the four physical binary oppositions but further abstracting the "species" concept into the single species property of 4 pieces sharing one binary opposite.	Mono-quality aggregates in finitely variable locations. Any single quality can "win."	Determinate Exploration of large finite space of weak species concept [*value of same pattern of determinateness for each of 16 qualities*]

δ* *2-Place Logical Connectives	Small Finite Combinatoric for Indefinitely Large Finite Links btwn. Sentences w. Nominal Predicates	**[2x2x2x2] – Table of All 16** possible 2-place logical connectives each as a "species" for combining sentences (Enderton Table VI, p. 51.)	Takes finite system of "true/false" truth tables which are physically realizable, to enable larger finite combinations of sentences.	Mathematically closed mappings over enumerable connections between sentences with truth values	Closed table of truth functional connectives for large finite sentential constructs [*value of strictly constructive sentential content*]
Countably Infinite ***Computer Programs***	Large Finite Programs that Must Halt (Must finish computation)	*Requires Countably Infinite Theory*, but must have finite physical completion	Concrete Physical Realization of Universal Turing Machines doing finite calculations including logical connectives.	"Discrete symbolic precisions" of recursively calculated outputs	Well-formed & effective programs with algorithmic agency [value of *mechanically-symbolic agency*]
Full Predicate Logic Symbolizations	*Theoretically Countably Infinite.* Yet, all actual deductions must be finite.	No largest Integer. ("For every natural number *n*, *Successor*(*n*) is a natural number" – Peano Axiom 6)	Closed Abstract Symbol Systems of Inference that can be determined in a finite number of logical steps in formal language expression.	Mathematically essential truths expressed within symbolic formalisms	Truth-functional deductions limited to expressiveness of univocal terms [*value of proof certainty*]

Continuation of Table III-7 Comprehensive Heuristic of the Transformations

All this may be a bit head spinning, as are our times in general with all of their scientific and technologically induced changes from individual to global scopes may have a similar effect. The Summary Heuristic now extends from small, finite combinatorics through large finite combinatorics to infinite symbolizations. In relation to this expanded Summary Heuristic, I will limit the present discussion to the new implications of the third (γ) and fourth (δ) models. In this newly expanded heuristic, the third and fourth models can shed some light on the emergence of computational aesthetics, since both of them – like computer programs – stop with their large finite, and indefinitely countable but ultimately finite numeracies. This discussion will involve some further inquiry into new aesthetic qualities and possible modes of catharsis via a return to

Kant's aesthetics in his third critique and especially his theory of the sublime and its engagement with the human capacity to conceive infinity.

In the Zeno-like race to grasp the realm of large finite numbers made available by computers, at first we appeared to be Achilles-like by seeming to outrun all the messy problems of humanity through computers' disclosure of patterns and recurrences previously unavailable to humans. This initial promise of escaping human virtues and vices is made possible by fulfilling the promises of Descartes' and Leibniz's "*Mathesis Universalis*" and *Calculus Ratiocinator,* which are realized in more determinate ways by building actual Universal Turing Machines and running programs that halt on them. My project can only indirectly engage with the more "tortoise-like" problems of "re-engineering" (Wimsatt 2007) our inevitable "return to [the finiteness of] the cave" (*Republic vii.* 514a- 517c; Sinaiko 1965, pp. 167-184), after we have glimpsed the recently emergent sun of countable infinity with its uncertain relationships to the good for humanity and the conditioning circumstances of all life.

As intrinsically "limited beings," we come to see that despite computers' highly mathematical algorithms and large finite data-based strategies for machine learning, our technologies are not intrinsically above their human applications and consequences for ourselves and equally important, for our living and geophysical surrounds. Accordingly, we are responsible for assimilating their "piecewise approximations to reality" (Wimsatt 2007) as teleological finite beings. Moving slowly, it may be possible to sketch out a few of the issues along the way. We will start with a consideration of the "disciplinary character" of a computer programmer, and then (drawing on Kant's third critique) open up a more direct discussion of telic significances in light of the aesthetics of the sublime.

Examining a Typical Pattern of Disciplinary Culture

Any modern discipline practiced at the professional level inevitably develops some sort of cultural silo as intrinsically required for its rigorous view of its own subject matter. Crossing between such silos always involves reshaping one's world views in order to find what is characteristic for practitioners in that field of expertise working within its peculiar boundary formations. *Working across* such boundaries inevitably involves a reshaping and transforming of what is basic and what is consequent, as variations in expertise produce a Rashomon effect among the different sequences of inquiry and knowing (Richards 1992, p. 28), thereby setting up potential conflicts and misunderstandings as well as possibilities for conjoint productivity and problem solving. One might even call these *crises of expertise,* especially as connected to struggling with "wicked problems" characteristic of the human condition in the context of highly developed scientific and technological expertises (Rittel & Webber 1973, Buchanan 1992, Erickson, et. al. 2013, Stoppard 2015, Auburn 2001).

In our present context of inquiring into varied finite and infinite models of numeracy and their differential telic expressiveness, we can at least envision an understanding of the *character of the computer programmer* as a person-expertise pair in the same way that Plato envisioned the character of the "theoretical man" (Benardete 1981, I.89, I.102) in the person of Theaetetus the young mathematician. In the dialogue *Theaetetus*, Socrates is delighted to encounter such an excellent abstract thinker with a solid and generous character as an interlocutor. In the end, Socrates learns a great deal from Theaetetus, just as Theaetetus benefits from Socrates' midwifery for Theaetetus' mathematically conditioned intuition, but nonetheless naïve identification of perception with knowledge. Theaetetus had mathematical knowledge but did not have knowledge of the <u>qualities of human being as such</u> discursively available. That is, Theaetetus had a formally complete knowledge of how to geometrically commensurate rational and irrational numbers, but he did not have knowledge of the full range of human experience, starting with his own.

For the development of computing as a science, one typical aspect of its disciplinary culture is that the *eidetic perception* of being programmable has played a crucial role in its determination of how scientific and computed facts can be noticed in a mode of disciplinary expertise and well-intentioned technical strategy as invoked and practiced by computer scientists. The discipline of computer science provides a stable situation wherein the formal language precisions of programs in a larger sense are substituted for a deprecated natural language discourse. A frequent response to the difficulties of programming the *behaviors* of "process X," is to say "Whatever X is, X's *behaviors* are programmable!"[42] Such recurrent optimism arises from the discipline's conceptual basis in the countably infinite. To be a computer scientist or programmer, one must always frame problems such that they can be solved through indefinitely large but ultimately finite computable combinatorics. Such framing must reduce out any aspects that would exceed such a complete computational solution. Within the field of computing itself this fact is referred to as a problem being 'intractable' where being "too complex" strictly means 'too complex' because the internal structure of the problem grows at such a rate that it outraces any practical computational power. That problems might be "wicked" ((Rittel & Webber 1973,

[42] Of course, such a disciplinary commonplace is posited at all levels of sophistication from autodidact geek to breakthrough computer scientist. The original stamp or character of "I can program 'that'" has been deeply assimilated into the disciplines of programming and computer science. I am here drawing an idealized disciplinary character in an analogy between Theaetetus as a 'theoretical person' and the required conceptual and technical expertise demanded of a computer scientist. It is this shared aim at formalism as a distinctive idealized kind of character that provides the analogical connection.

Buchanan 1992), or not strictly logical in their complexities is ruled out from the beginning. Hence we get the formal behaviors of the computed imitations of "process X.'

For our case, let "X" be the determining of computing procedures for "making tragic plays" such as *Hamlet*. What the aspiring programmer-artist actually might mean (if elicited by Socrates) is that: "It is possible to write a program that will sequentially present *depictions of actions* as either a *combinatoric arrangement of merely similar speeches* or, more productively, generate computationally enhanced representations that imitate Hamlet-like "play-within-a-play" patterns of expression that are 'computed contents and displays' with similar metapragmatic effects to what this Shakespearean tragedy presented on stage." The analogically and associatively inspired programmer's intent is to replicate the making of the tragic catharsis, which was originally composed by Shakespeare in a *higher order qualitative-discursive form*: Shakespeare concretely signified the tragic catharsis in natural language *and* through the tragic play metapragmatically performed its plot on the stage under the interpretations of the actors. In computing, such an <u>analogically inspired mode of intended replication of behaviors</u> takes place all the time in computer-generated imagery (CGI) to deeper or shallower effect. (In the instance of CGI, computing primarily provides a medium for the story teller.) Shakespeare could just as well have written Hamlet on a computer or had a computer generate pictures of actors in sequence, but that does not mean that the catharsis of Hamlet's uncertainties about the king in the emerging culture of modernity is programmable per se, i.e. as capturable within its mathematical formalisms with procedural certainty incorporating stochastic methods. Even our existing computed artistic representations require outside "data" and "patterns" gathered from life activities for computational manipulation and discernment. Nor does it mean that

Shakespeare's (or Greek) plays are fully artful for the comedic or tragic conflicts of our current technological culture.

In conjunctions of higher order qualitative-discursive form and higher order quantitative-symbolic form, what holds real promise are the syntheses of computational techniques <u>and</u> humanly concrete elements of narrative and drama which are culturally emerging (e.g., the early work of Janet Murray's pioneering *Hamlet on the Holodeck* 1998). Such "recursive depictions" are actually a new form of "mechanical imitation," that is based in large finite simulacra and datasets of recorded human or other natural behaviors. Simulations are actually *numerical analogies*, imitations of the presentations of real phenomena through numerical relations as means or media seeking to capture the "true" or mathematically expressible forms discoverable in the phenomena. By computing symbolic representations of whatever kind, we gain access to potentially useful analogies of fully significant human experience, and we can respond to them from our lived interactions to extend and sometimes complete their significances for us. The good intentions of computer scientists are *actually required* by the discipline-forming practices aimed at finding computational strategies in analogy to human (and other) behaviors of whatever sort. In fact, science would be seriously impoverished if such analogies were objected to as incomplete, lacking full human significance, etc., and thereby hindering the development of new sciences and technologies. Each science and discipline needs its silo of expertise to make its specialized contributions.

Nonetheless, the computational formulations for producing such effects cannot fully capture and express the very nuances of the human situations imitated with their socially, politically, and individually embedded impacts and consequences on actual people, other life-forms, and our natural environment. Whatever the algorithms and programs are *intended to do* is intrinsically a small part of *what they are doing and will do* in concrete human, biological, and physical situations. One could easily appropriate Dewey's statement about physical science: "Multitudes of new qualities have been brought into existence by the applications of [computer] science." The present-day exposés of "bad behavior" on internet and other technology are but the most immediate instances of such gaps. The disciplinary limitation indicated by the very silo of expertise mandated is that computer and related sciences are not equipped to find, formulate, and resolve such issues from within their disciplines alone, especially so since the discipline itself heavily depends on existing cultural achievements as sources for analogies even as it changes them. Whatever solutions may be available will have to be at least multidisciplinary *and* necessarily by means of ethical and political reforms as well. Moreover, these solutions will be neither universally valid, nor temporally permanent. They will, however, certainly involve large finite complexities with large ranges and domains of implications.

With regard to disciplinary silos, if we turn to Aristotle's differentiation of poetic science, we find three different disciplinary "characters" – the Poet, the Historian, and the Philosopher – whose works are arranged into a topic wherein "poetry is something more philosophic and of graver import than history" (ch. 9). The Philosopher has access to ideas as Ideals that are or may be experienceable <u>to some degree</u> within actual human conditions; the Historian has access to ideas through the actual particulars of occurrent events that can only imply such concepts at work in the events; and the Poet has access to ideas through the production of works of art that aim at ideas through expressive actions or depictions, but does not conceptualize them except as statements or gestures within the work of art.

All four disciplinary characters – Theoretical Person, Philosopher, Historian and Poet – have their own access to ideas in their own ways. Where does the character of the Programmer fit into these four? She too has her own access to ideas, yet in a differentiable way. The Programmer has access to ideas through their computability, that is, those particular mathematical ideas that can be *effectively* stated and calculated within countable infinity. These ideas find a specialized formal completion through their capture of what could potentially be countably infinite and yet, when tractable, are guaranteed to find an end to computation for any properly formulated calculation. These ideas have a specialized name: 'algorithms'. An algorithm is a "procedure or set of rules used in calculation and problem-solving; (in later specialized use) a precisely defined set of mathematical or logical operations for the performance of a particular task" (*OED*).[43] Moreover, algorithms can have concrete agency; they can perform mechanical actions within the world.[44] Thus, the Programmer as such introduces a new character variant within the human life-form into the world. She has an emergent "character" in the course of human events that is not yet fully understood and culturally situated. "Geek" does not even begin to tell the story; it merely hints at the special devotion that programmers must have to realize their effective ideas.

Perhaps we can gain a bit more insight into this character of the Programmer by looking at her productions. What is the status of such computed artifacts of symbolic action in the world? They are certainly neither deductively warranted under universal physical laws which care not for the existence of any life-forms, nor are they strictly separate in humanly unbiased "objective

[43] See also the "Algorithm" entry in *The MIT Encyclopedia of the Cognitive Sciences (MITECS)*, Bradford Book; New Edition (September 1, 2001), for a more developed definition and exposition.

[44] See Kevin Slavin's TED talk "How algorithms shape our world" at: http://www.ted.com/talks/kevin_slavin_how_algorithms_shape_our_world.html, Brett Stephens' How Plato Foresaw Facebook's Folly - Technology promises to make easy things that, by their intrinsic nature, have to be hard."

algorithmic certainties." Nor do they necessarily provide the same theatric experience as pre-computational works of art. Rather it is the unintended consequences and emergent qualitative relationships of humans *and* computers that are of interest and concern when taken together within the larger human condition now inclusive of this "defining technology" (Bolter 1984).

With regard to this new defining technology of computing, one fundamentally new question to ask here is "What is humanly universal about effective languages?" It is a very different question than the mathematical question of what is a Universal Turing Machine, i.e., for which we have formal symbolic and technological answers. This foundational question is an intrinsically telic question that asks both: "*What can the artist aim for* to disclose the purposes and perils of computed artifacts in our interactions, communities, and cultures as newly emergent phenomenal aspects of the human condition that are in need of cathartic resolution?" And, "What can such artifacts disclose about our human situation in the contemporary world?" As such, a directly theoretical approach to this difficult path of inquiry is beyond the scope of the present philosophic project. Or as Aristotle said: "Now, to go further in examining (*episkopéw*) whether tragedy is or is not by now sufficient in respect to its kinds, in order to judge it both by itself in relation to itself and in relation to the spectators, is another account (*logos*) (*Poet.* 5. 1449a7-11. Benardete/Davis trans.).

For this problematic, one recurrent constituent is clear: this foundational and intrinsically telic question poses an inquiry that philosophers, historians, poets and mathematizing scientists themselves will need to undertake in order to turn to works of art and artistic practices for concrete poetic and cultural insights towards virtuous and just effects. There are entire new manifolds of artistic instruments and works already being developed,[45] and we are only beginning to understand the *human reversals* they portend, and to creatively imagine into poetic idealizations that may resolve such conflicts into teleological consummatory acts. The foray into Kant's appropriation of infinity to aesthetics that follows later may at least point in one direction of such a neoteric inquiry.

Within the present Scene of inquiry, we can nonetheless turn towards the project of laying some ground for questioning "computed artifacts" in relation to the interdisciplinary field of Digital Humanities. We can begin by posing this issue: what can be computationally "AND-ed," "OR-ed," and "NOT-ed"[46] as separate commands are connected into programs with their formally limited expressiveness as they manipulate their symbols with their nominalistic references? What can programs do within their symbol systems alone? This issue becomes a problem when we encounter programs and inevitably attribute additional human value significances to them. Computational significance does not end with the "result"; programs have extra computational meanings in our experience. Moreover, we must now reflexively include the

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[45] As merely one example, see: "How A.I. Is Creating Building Blocks to Reshape Music and Art," https://www.nytimes.com/2017/08/14/arts/design/google-how-ai-creates-new-music-and-new-artists-project-magenta.html?em_pos=small&emc=edit_tu_20170815&nl=bits&nl_art=2&nlid=1971203&ref=headline&te=1&_r=0

[46] The NOT connective provides sufficient formal closure when combined with either AND or OR to allow such a pair of connectives to express all sixteen possible connectives. In effect such connective pairs constitute an analogous function to Aristotle's concept of species as a means to secure essence through definitory comparisons and contrasts of causes. They both serve as a means of grounding comparisons and contrasts, one qualitative, the other truth-functional in a combinatorically complete formal system. (There are also other groupings of connectives that provide 2-place formal closure. Two of the connectives, NAND (Negative-AND) and NOR (Negative OR) are each on their own capable of expressing all 16. They are put to practical use as core kinds of logic gates used by computer chips.)

very “discrete” character of the computed relationships themselves that differs from our current cultural evaluations in our interactions with them. Programs intrude a kind of symbolic precision with its own character into human affairs. We are now living such hybrid interactions on a pervasive basis. Each program statement must be discretely effective on its own as a step within the construction and running of a program. Running the program has external significances beyond what is computed. Of course, actual programs (and actual people) are <u>vastly</u> more complicated than this example can reveal.

As far as an interdisciplinary field of “computing and the humanities” is concerned, there is the persistent disciplinary duality of [computing the content of the humanities [vs.+] the humanizing of computed artifacts to help produce a healthy and just culture]. Both sides of this duality are intrinsic to any interdisciplinary formation of a Digital Humanities. Obvious as this may seem, such disciplinary formation still needs to be conceptualized and enacted in practice for the duality to take on purposive significance and consummation in our time and conditioning circumstances. Aristotle’s response to Plato’s challenge for returning poetry to the city was precisely a *technê* of *mimêsis poiêsis* that met the demand of Plato’s version of the duality, i.e., [questionable poetic art [vs.+] the good for the city], for Classical Greek times and circumstances. For our times, Brenda Laurel’s pathbreaking book *Computers as Theatre* (1991) is one significant contribution to the challenge of developing humanistic computing with its explicit merger of Aristotle’s *Poetics* as a guide to software design aimed at improving human access to computational power (see fn.14).

Provisional Anticipations of Contemporary ‘Telic Significances’

> We have laid it down that a tragedy is an imitation of an action that is complete in itself, as a whole of some magnitude; for a whole may be of no magnitude to speak of. Now a whole is that which has a beginning, middle, and end. … A well-constructed Plot,

> therefore, cannot either begin or end at any point one likes; … Again: to be beautiful, a living creature, and every whole made up of parts, must not only present a certain order in its arrangement of parts, but also be of a certain definite magnitude. Beauty is a matter of size and order, and therefore impossible either (1) in a very minute creature, since our perception becomes indistinct as it approaches instantaneity; or (2) in a creature of vast size – one, say, 1,000 miles long – as in that case, instead of the object being seen all at once, the unity and wholeness of it is lost to the beholder. Just in the same way, then, as a beautiful whole made up of parts, or a beautiful living creature, must be of some size, but a size to be taken in by the eye, so a story of Plot must be of some length, but of length to be taken in by memory. (*Poet.* 7. 1450b23-51b6. Bywater trans.)

In Aristotle's age, imitative making produced works of art that were well-matched and accounted for in his genus of poetics-itself. As noted earlier, contemporary art can and already does[47] produce new roles and situations for agents – namely, artists – to explore for resolutions of these highly affect-laden problems that significantly impact our current, extremely complex human conditions. All of this then become phenomena of a generalized "city" that is no longer geographically localized and is intrinsically multiple in its particular determinations. The artist's power is to create works of art that are not only satisfying to herself, but also to express the possibility for that satisfaction to take place in the person appreciating the work of art (Dewey 1934, Collingwood 1938). In that sense, the performance of an interaction of artist, work, and appreciator in a concrete individual, social, and cultural context is intrinsically a teleological consummatory act that takes place in some actually functioning assemblage of all the factors surrounding the four sources of experience in the relationship. Such assemblages of interactive *performances* of artist, work, audience, and cultural context *produce* their own specific telic effects. (Of course, one could conceptualize this experiential relationship in different ways as well.)

[47] As Hayles has observed, the variety of science fiction genres constitutes the most advanced poetic art form in this regard.

This framing leads us to surface an underlying issue for the combinatoric explosions of contemporary art: In the multiple "ethos-neighborhoods" and "partial tribes" with their particular common sense habitats of today's "generalized city", can places for "teleological consummatory acts" be found that are also cathartic for the very issues (tragic and comic) engendered by the existence of the multiple communities that artist, work, audience, and context exist in as well? The above sequence of models (α, β, γ, and δ) provides a provisional account of the variety of concrete and abstract modes of reference and fact generation that are both varied in their overlapping concreteness *and* with different "forms of numeracy" across their range. Today's artists have these resources ready to hand through contemporary electronic media, travel, and other technologies. They are explosively producing works with access to all these possible artistic materials, human actions, poetic techniques, and cathartic ends. Underlying all this is the question of how can we begin to grasp their new varieties in ways that facilitate community in and across such a plurality of contexts? What sorts of culturally nuanced "free variables" might we need to enable today's need for cathartic effects?

In order to deal with our current highly particularized cultural and individual differences across the range of human endeavor and under our contemporary conditions both scientific and cultural, we must now tell hybrid stories that cross genre "language games," social grouping boundaries, and technologies, much as we all weave between institutions and communities on a daily basis as *matters of course;* and that disclose <u>concrete</u> human commonalities as *matters of* *phenomenal fact*.[48] [49] We also need to enact multicultural plays and other works that problematize the concrete and persistent differences between living communities in order to abduct forward-looking and backward-acknowledging cathartic resolutions. And finally, we have to build pluralistic arguments, both scientific and cultural, that not only recognize the specificities of a field of essentially contested issues (Gallie 1955-56), but also come to grips with how such a field can nevertheless scaffold higher order unifications of both formal and discursive sorts in theory, practice, and production, as well as possibilities for intractable conflict and war. All of this must be conducted with the intent of increasing the sustainability of humanity's "ecosystem" across time and circumstance, inclusive of reduced law-like certainties of nature and deductive necessities of mathematics, but never with the expectation of achieving similar law-like certainties for the evolving human condition. Both modes of scientific certainty tend to lessen or eliminate recurrently evolving diversities, and disparage pluralities of life-forms by reducing them to the outcomes that they both appear to (and sometimes actually do) effectively predict and control, while leaving the rest to mere chance or subjective events. Rather, it is the diversities and pluralities that are also scaffolded by scientific and technological achievements grounded in those certainties that we seek to humanize more precisely – but in ways that claims of absolute universality and completely necessary truths would truncate.

[48] For related modes of discussion, see Richards 2008, "The Moral Grammar of Narratives in History of Biology -- The Case of Haeckel and Nazi Biology", and Latour 2004, "Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern."

[49] It has recently become quite clear that the very concept of a "fact" has become detached from concrete significances as "fake news" and many other sources of deception have incurred upon public and social media. That actually poses issues about the concept of "fact" in the first place.

In a very provisional way, then, the overall exegetical project seeks to provide support for developing such a field of aesthetic resources. As only a beginning, this field would be conceptualized through an extended comparison and contrast by progressively discussing the sequence of increasingly abstract models. The models range from the exegetical reconceptualization of Aristotle's small finite model, then to a small concrete physical model of "species differentiation" exhibiting similar Aristotelian patterns, then on to a transformation of this second model into one with a larger finite range of "species," and finally to an explicitly infinitary formal generalization found in the uses of the table of sixteen logical connectives in propositional logic and computing. This range then bridges from a Greek sense of *arithmos* that is embodied in a close relationship of numeration to actual physical referents including things *and* people, all the way to a radically more abstract first-order logical structure with a countably infinite truth functional coherence that is freed from dependence on immediate phenomenal reference at each step. Thus, the above sequence enlarges the numeric scope of "species" differentiation towards the purpose of sketching conceptual structures for an emergent contemporary aesthetic in part based in the functional patterns, beauties, pleasures, and productions of "large finite" models especially associated with computational systems. Yet such a larger finite model must not be formally severed from actual human experience if it is to retain or enhance full aesthetic power.

In relation to the sequence of models, one surprising realization from the second model (β) is that it is fully possible to identify a formally coherent scientific model of classification at work in Aristotelian science. In effect, this fact demonstrates that Aristotle's science has an *argumentative form* expressed in extended discourse. His science has a predominately "discursive syntax" rather than the modern idealized notion of a discourse composed strictly under a “propositional syntax” that eliminates polyvocal terms (Ceccarelli 1995). Another surprising realization is that Aristotle’s distinctions between actual infinity and potential infinity (Lear 1979) appear to remain coherent with our modern higher-order mathematical abstractions. That coherence provides us with fresh opportunity to understand the difference between countable and non-countable infinity with regards to works of art by opening up a view to differences between Aristotle’s concrete small finite resolutions of poetic species shaped aimed at *telic realizations*, and the character of how large-scale finite resolutions and their potentials for telic realizations might be understood.

Without Aristotle actually knowing about such a “countably infinite” subfield of absolute infinity at the time, his model can be put into a sequence of models that bridges or interfaces between the different modes of numeracy. He may not have had Newton’s universal physical laws or Einstein’s theory of space-time relativity, but he had a firm grip on the human and natural significances of infinity that remain of coherent interest today. Following Plato, Aristotle apprehended that the return to the finite characterizes the boundaries and completions of being human. That this apprehension is even possible is surprising since the difference between ancient and modern systems of thought seems entirely incommensurable (Kuhn 1987). My claim is that Aristotle’s apprehension is possible precisely because his science is not only built on logic, but on a “term logic” that permits polyvocal scientific terms with manifold coherences within extended discursive argument. Scientifically developed polyvocal terms are not conflicting and self-contradicting; they ground conceptual and methodological unifications of the one and the many. Such hybrids of larger finite, computationally precise communicative structures *and* concretely experienced natural language structures have the potential to scaffold new artistic problems and possibilities for production and performance. These hybrids may even provide insight into how biological and human sciences need to develop new discipline and cross-discipline-aware[50] ways of incorporating polyvocal scientific terms into their sciences, at least in the contexts of extended argumentative discourse and public practice.[51]

Anticipating a Kantian Sequel

In a later project, I will turn to Kant's fully infinitary theory of experiencing the sublime in order to exemplify the shift towards the more concrete experiences of all the increased precisions we are living with and are already occurring in art objects today. (For two examples, see many of Jason Salavon's works, http://salavon.com, and Ann Lecke's *Imperial Radch Trilogy*.) In this later project, I intend to provide a basis for extending purposiveness to a downstream notion of a sublime that is re-grounded in the less ultimately overwhelming but nonetheless more spacious *large finite* complexities of computations, built on the narrower concept of a strictly countable infinity.

The truly strange, even mysterious, fact is that formal systems, such as mathematical logic and the theory of Universal Turing Machines, are all built upon the possibility of characterizing each distinct proof or each "halting" computer program by a single finite, but usually *very large finite* number, called a Gödel Number or a Turing Number respectively. The existence of such a number signifies the possibility that a specific proof maintains truth

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[50] Many thanks to my colleague Zoe Nyssa for pointing out how scientists are already assimilating disciplinary reflection into their scientific practice. Her research (Nyssa 2014) concretizes this phenomenon found in her field work to determine whether there is an environmental science, and if so, what might it be. It was truly surprising to find that throughout the range of environmental and biological scientists practicing in the public sphere, they're completely aware of different understandings and discourses bearing on their problems and actions, and currently attempting to bring all of that to bear on genuinely "wicked problems" (Rittel & Webber 1973, Buchanan 1992, Erickson, et. al. 2013).

[51] A future project will be to explore the phenomena of numeracy in Kant's Aesthetics of the Sublime. (See endnote *iii*.)

functionality or that a particular program executes to a proper stopping point. This fact would have made our mythical Pythagoreans happy in their belief that everything has a "number," had they had access to this mathematical knowledge. Gödel used this fact to prove the fundamental incompleteness of first-order logic, and Turing used it in his proof of the undecidability of the Halting Problem (*Entscheidungsproblem*). Such characteristic numbers can be mechanically calculated (Newell and Simon, 1976) based on the "arithmetization of syntax" central to the rise of modern formal systems. In that sense, they profoundly advance the "mechanical" science that Kant finds inadequate to capture the "aesthetic purposiveness without a purpose" of fine art, i.e. fine art is *more than* strictly conceptual. In addition, for Kant, mechanical science was fundamentally inadequate for expressing the teleological purposiveness of living things that humans have immediate experience of through our own biological existence and higher-order cognitive capacities. So much so for Kant that, as Robert Richards claims, Kant did not think there could be a science of biology (Richards 2002, p. 231).

Nonetheless, Kant's critical articulation of the subjectivity of cognition in an age of experimental and mechanical science may be able to lead us to a place where we can understand how "purposiveness without a purpose" and teleological consummatory acts[52] are also at work in the procedures and conceptual models of scientific research conducted by humans – through the new modes of actively disclosing previously unrecognized phenomena by means of "representing and intervening" (Hacking 1983), which now includes computational artifacts. Such computational artifacts each have a theoretical 'description number' which is a counting or natural number within some encoding system that is the Turing number for that programmed

[52] See previous section on 'Plot' as the vehicle of catharsis as a 'Teleological Consummatory Act'.

artifact. That is to say, experimental regimes – including those using computation – are also *productive* and *performative* like the arts of poetics, and are so in ways that cannot have the *a priori* analytic or synthetic certainty of knowledge of phenomena beforehand (Quine 1953) that we so desire. Semantically we can see that the very name “description number” indicates that each artifact has a specific number of its own that cannot have its halting property be “decided” ahead time. The program must be run in order to “decide” it halts: in that sense, it is empirical. Theoretically guided experiments can only have the more limited certainties of formal closure and disciplined practices *siloed within the processes of conducting scientific research*. They are siloed in order to remain open to the surprises of nature and the complexities of living beings. Such experimental regimes are constitutive of an open-ended purposivenesss that can only be resolved through observing the responses of physical and organic nature that can then be “saved” through scientific knowing.

However, those disciplinary “silos” are also problematic. Beyond “command and control” *over* nature, we human animals must also “interact and abide” *with* and *within* nature. If these new phenomena are to be successfully acculturated within the more comprehensive aim of life-form flourishing, they will have to be grasped not only in mechanism and theory but also grasped and understood in discourse *and* experience in order to humanize them, and with further science even to biologize them. In order to do this, these new phenomena have to be articulated at all levels, and especially brought to life in the intrinsically diverse “habitats of common sense.”[53] *Modern science intentionally opens up standpoints into the potentially overwhelming*

[53] I am building a teleologically informed concept of “common sense habitats” here that is relevant to the human cultural situation from both a biological vocabulary and its sociological adaptation. Two of the frequently ignored aspects of “common sense” are a) that there is a plurality of different “common sense habitats” rather than a universal human capacity or faculty

and destructive powers of both physical and biological nature, but with an expectation of command and control siloed inside disciplinary boundaries that intentionally leaves out the work

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of "common sense" that is the same for everyone, every culture, and every historical condition, and b) that communities of all sorts, including scientific disciplines and political parties, have their own shared beliefs as to what makes "common sense" as a basis for common activities and that also serve as ways to construct boundaries between one community and another. Any situated inquiry will need to take these facts into account as conditioning circumstances for inquiry.

Here is an interdisciplinary semantic background for my concept of "common sense habitats," from four presumed to be conciliatory approaches: In ecology, 'habitat' signifies "… the type of natural environment in which a particular species of organism lives. It is characterized by both physical and biological features. A species' habitat is those places where it can find food, shelter, protection and mates for reproduction." (Wikipedia entry for "habitat." Accessed 10/13/18.) *Since the human species is biologically dependent on culture*, it is reasonable to extend that notion. In sociology, 'habitat' signifies "… ingrained habits, skills, and dispositions. It is the way that individuals perceive the social world around them and react to it. These dispositions are usually shared by people with similar backgrounds (such as social class, religion, nationality, ethnicity, education, profession etc.). The habitus is acquired through imitation (mimesis) and is the reality that individuals are socialized [into and] which includes their individual experiences and opportunities. Thus, the habitus represents the way group culture and personal history shape the body and the mind, and as a result, shape present social actions of an individual." (Wikipedia entry for "Habitat" (Sociology). Accessed 10/13/18. Underlines mine.) In anthropology, "Bourdieu's concept of habitus was inspired by Marcel Mauss's notion of body technique and hexis. The word itself can be found in the works of Norbert Elias, Max Weber, Edmund Husserl and Erwin Panofsky as re-workings of the concept as it emerged in Aristotle's notion of Hexis. For Bourdieu, habitus was essential in resolving a prominent antinomy of the human sciences: objectivism and subjectivism. Habitus can be defined as a system of dispositions (lasting, acquired schemes of perception, thought and action). The individual agent develops these dispositions in response to the objective conditions it encounters." (Wikipedia entry for "Pierre Bourdieu". Accessed 10/29/18.) In continental philosophy, Gaston Bachelard's *Poetics of Space* (1958) gives a situated poetic imagination in the context of a phenomenology of architecture as a lived space of experience: "The house, quite obviously, is a privileged entity for a phenomenological study of the intimate values of inside space, provided, of course, that we take it in both its unity and its complexity, and endeavor to integrate all the special values in one fundamental value. For the house furnishes us dispersed images and a body of images at the same time. … I shall prove that imagination augments the values of reality. A sort of attraction for images concentrates them about the house. … we must go beyond the problems of description – whether this description be objective or subjective, that is, whether it give facts or impressions – in order to attain the primary virtues, those that reveal an attachment this is native in some way to the primary function of inhabiting." (*Poetics of Space*. 1964, pp. 3-4. Underlines mine.)

of recurrently adjusting our culturally scaffolded life-form for ecological sustainability amidst all life-forms as a *merely subjective externality*. There appear to be many more, increasingly precise and "countably" attuned, aspects of *sublimity* into which our arts need to be acculturated. Doing so may provide bridges to wider cultural insights and the very needed transformations of virtues and social contracts into just and lawful ways of acting.

Ultimately, I expect such a further opening up of the teleological consummatory acts – intentionally conducted within scientific activities and that have the aim of finding hidden natures – may provide concrete starting points for the needed cultural work, even while they will fall short of providing a conceptual basis for doing that work from a strictly scientific standpoint. Further connections may be articulable in light of the aesthetics of "arts expressive of the large finite," and thereby establish that there are non-exclusive *and* non-contradictory regions of meaningful analogy and coincidence between a poetics of science and a science of poetics, shared regions that can serve to integrate and bring justice to different cultural habitats within a single culture and time *and* across cultures and times. In order to begin that work, I will build on the ordered sequence of "cultural numeracies" developed above that are both trans-historically and cross-culturally situated in that they can and do occur in different community localizations that are constitutive of their particular common-sense habitats.[54]

[54] There are very real differences of degrees of numeracy to be found around the globe today. A clear instance of innumeracy was reported for disaster recovery efforts as indicated by this statement, "Instead, the military has tried to instill order. … <u>military personnel dispatched to Palu struggled to calculate the body count, stumbling over basic addition.</u>" (Hannah Beech and Muktita Suhartono, "Nature Cursed Indonesia, but It Took Neglect to Make a Disaster," *NYT* Oct. 16, 2018). Nonetheless, such localized differences cannot be reduced to [numeracy vs. innumeracy] despite very deep beliefs that mathematical concepts are fully intersubjective and atemporal. Different cultures have different modes of knowing mathematical concepts, and very different cultural embeddedness into the lives of people within a culture. An excellent example of this difference is given by Edwin Hutchins in his *Cognition in the Wild* (1996), which details

The deep problem is that there are deficiencies and gaps across such numeracy habitats both within a culture and across cultures that make communication and community discontinuous; they thereby suffer the disruptions of un-reconstituted opacities and intended oppressions that are already violent or lead to violence. Aristotle already knew a good deal about infinity and captured a high cultural understanding of it in his distinction between "potential" and "actual" infinity. Brilliantly, he also did the work of bringing his understanding of mathematics into his concepts of "distributive" and "rectificatory" justice in ways that did not require all citizens – including even the humblest members – to grasp mathematical infinity while still participating in the good of their city (*N.E. Bk. v*). Kant's differentiation of the sublime into "mathematical sublime" and "dynamic sublime" (*COJ* Bk. II, §23-29) may serve to help us think about our new understandings of the artifacts of countable infinity as experienceable and reshape them towards justice in community.

Today we have achieved concrete artifacts that physically embody a countable infinity as a computational potential that is realized when the program is run, and surprisingly, that potentially everyone on the planet can possess, whatever their background and common-sense cultural habitat. This technological achievement provides immediate experiences of countable precisions that are presently extremely disruptive and open to vast exploitation, yet so far we do not have justifying and rectifying cultures to order and ameliorate those dangers. I contend that working on this deep problem requires an understanding of the different modes of numeracy as they are lived and encapsulated in diverse common-sense habitats.

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the differences in Western versus Micronesian "Pilotage." A vivid representation of the Micronesian navigation system can be found in the movie *Moana*. My point is that there are substantive differences in numeracy across different common-sense habitats that have to be accommodated in cultural reconstitution.

In this scene (III) I have laid out a sequence of underlying transformations in "cultural numeracy," starting from the 'discursively polysemic' and 'small finite numeracies' (Phase 1: models α and β), which are closely appropriate to Aristotle's science. In the sequel, I will turn to the cultural numeracies with 'large finite' and 'countably infinitary' properties (Phase 2: models γ and δ) that will provide a numerate context for that later project on aesthetics under the influence of countable infinity. That later project, however, will be another story.

Interpretive Scene IV: ***Overall Interpretive Approach as Grounded in Greek Sentences 1 & 2 of the* Poetics *As a Concrete, Composite Whole of Discourse Exemplified through Productively Ambiguous Scientific* 'Arithmoi *of phenomena' as transformed into* 'Arithmoi *of Hybrid Significances'***

Experience has temporal continuity. There is an experiential continuum of content or subject-matter and of operations. The experiential continuum has definite biological basis. Organic structures, which are the physical conditions of experience, are enduring. Without, as well as with, conscious intent, they hold the different pulses of experience together so that the latter form a history in which every pulse looks to the past and affects the future. The structures, while enduring, are also subject to modification. … For every activity leaves a "trace" or record of itself in the organs engaged. Thereby, nervous structures taking part in an activity are modified to some extent so that further experiences are conditioned by changed organic structure. Moreover, every overt activity changes, to some extent, the environing conditions which are the occasions and stimuli of further experiences. … Cultural conditions tend to multiply ties and to introduce new modes of tying experiences together. … The process of inquiry reflects and embodies the experiential continuum which is established by both biological and cultural conditions. Every special inquiry is, …, a process of progressive and cumulative re-organization of antecedent conditions. … While *continuity of inquiry* is involved in the institution of any single warranted judgment, the application of the principle extends to the *sequence of judgments constituting the body of knowledge*. In this extension, definite characteristic forms are involved. Every inquiry utilizes the conclusions or judgments of prior inquiries in the degree in which it arrives at a warranted conclusion.

(Dewey 1938, "The Continuum of Judgment," 245-6. Italics mine.)

It is commonly accepted that excellent works of art and great texts are open to multiple interpretations that differ from person to person as each individual synthesizes their responses to the work. Taken together, it becomes clear that one person can in practice entertain the interpretations of another, and even that it is possible for a single person to have an enriched appreciation of the work by engaging it from a multiplicity of possible interpretations, even while the work remains open to such a diversity in ways that continue to suggest human universalities through the very nuances and qualitative indefinabilities of the work of art. In apparent opposition, it is also commonly accepted that science and mathematics must be conceptually determinate and present strictly true understandings of their formal objects or subject matters. And yet over time and through further theoretical and experimental developments, what was true and fixed knowledge yesterday undergoes fundamental transformations to produce new truths and newly certain facts today. Even at the heights of mathematical certainty and formal precision, one finds theorems such as Tarski's undefinability theorem for truth (1936), which stated informally amounts to the assertion that "arithmetical truth cannot be defined within arithmetic,"[1] as well as Gödel's famous incompleteness theorems. Furthermore, a given scientific theory may have multiple possible models, and even a subject as secure as (say) plane geometry has an axiom system that provides the possibilities for many different theorems that are not deducible *ab nova* without the benefit of ideational insights into possible regularities hidden within the axioms.

What then of the middle ground between these commonly accepted opposites of multiple versus singular significations, of polyvocal versus univocal scientific terms? (See footnote 26.) Is it even possible that there is a middle ground wherein people are able to discursively raise new questions, conceive of new unities, and experience "outside the boxes" of siloed expertise, as well as outside the habitude and received culture as a general capacity? Given our current conditions of rapid and profound change across the board from science and technology to art and society, it appears that the answer is a rather positive affirmation of such a generalized human capacity for crossing between the opposites, even as we may feel excited or exhausted by such changes. While there are obviously many sources and supporting activities grounding our capacities to change, reconceive, and improve our understanding and appreciation, I want to focus on those of natural language: at the hybrid conjunction of combinatoric structure and

[1] Tarski's undefinability theorem, https://en.wikipedia.org/wiki/Tarski%27s_undefinability_theorem.

representational expressiveness, of formal language and natural language, our contemporary natural language discourse can extend Aristotelian '*arithmoi* of phenomena' to '*arithmoi* of significances' that now include quantitative significations as well as concrete experiential phenomena.

Simply put, Aristotle's saved phenomena are qualitative in a rich fashion that includes all the contraries such as [Hot | Cold], [Noble | Base], [Brave | Foolhardy], etc., but these contraries are matters of qualitative degree *not* strictly numerical scales. Our culture has a manifold of numerical measures that we forget often have qualitative phenomena with which they are indirectly associated. For example, city laws often specify certain required night and day temperature minimums: we immediately convert such numbers into "cooler" and "warmer" in our experience. Accordingly, I am evolving '*arithmoi* of phenomena' to the broader meaning of "significance" to arrive at '*arithmoi* of hybrid significances'. This shift in meaning makes it possible to include our modern numeracies within the scope of a non-mathematical, that is, a natural language organizing or grouping of phenomena. 'Hybrid' then includes both lived phenomena *and* the existential references and impacts of mathematical formalisms under the single term 'significances'. The point here is that a great deal of computational and scientific framing consists of mathematized "technical details" without significance or wider meaning in themselves. They are critical to the computation or science but without any direct qualitative significance for the imports and influences of the computations and technologies they undergird. What we need to identify and make meaningfully coherent are the "significances" of those wider imports and influences that arise from the mathematics and technologies.

A simple example of this point can be made by considering the use of quantitative measures in all walks of life. I am *not* claiming that such measures cannot have existential reference. They can and very usefully do in many ways. Rather the issue is that such measures can be considered strictly in terms of their higher-order abstract relations within their formal expressions. Such relations encapsulated within formal expressions "have no meaning or interpretation save that which is formally imposed by the need of satisfying the condition of transformability within the system, with no extra-systemic reference whatever." (Dewey 1938, p. 398ff.) What is of present concern are the cultural/historical shifts in numeracy between a Greek *arithmos* and modern infinitely coherent mathematical symbol systems. If one starts out with a qualitative contrary such as [hot | agreeable | cold], then such a measure is intrinsically tied to our individual experiences of these ambient qualities. By introducing the linear measure of temperature as indicated on a thermometer, the Fahrenheit or Celsius degrees matching hot, agreeable, and cold abstract from our direct experience in such a way as to free reference to a particular person's preferences, environmental climate, cultural beliefs. etc. Consequently, for a city in a temperate zone with definite seasons like Chicago, the city government can legislate a mandatory lower bound of 66F at night, and a lower bound of 68F for daytime. This shift away from phenomena into abstractions is further consolidated in purely formal systems such as logic and Turing machines, as well as all the varied mathematical systems used in modern science and technology. One attempt to deal with the differences between lived experience and scientific abstractions is the Temperature-Humidity Index (THI) which attempts to be a measure of the degree of discomfort experienced by an individual in warm weather (Wikipedia search term "heat index"). Again, today one can readily imagine a multi-sensor electronic weather app – with user-friendly affordances to the underlying algorithm – that would allow users to specify what conditions are most comfortable for them and then change environmental controls accordingly through the Internet Of Things.

The problem is that not only are such systems routinely taken to be "freed from the necessity of any privileged interpretation" (*Ibid.*), they can also become incapable of robustly codifying our qualitative manifolds of experience. Despite the usefulness of Chicago's temperature laws for landlords, they do not account for the wider variability of the human experiencing of [hot | agreeable | cold] which includes those people in different circumstances that find a temperature of 66F too hot, too cold, or agreeable. Most importantly, the formal systems <u>still have impacts</u> within the field of qualitative experience that are not captured within the formalisms themselves. These formalisms are nonetheless often taken as if they still lacked any existential import and consequences outside of their encapsulated operations when in fact they have *many such significances*. Alternatively, by starting from the point of view of natural language discourse, one can incorporate univocal *terms* with technical precisions and thereby *assimilate formal languages to natural languages*; the opposite assimilation isn't always possible or even becomes combinatorically explosive. The fact is, we can talk and argue about these influences and impacts through the use of polysemous *terms* in natural language discourse which also has higher order polyvocality in ways not possible within formal symbols systems or even in their formal metalanguages. It is this problematic situation where our formal systems have been empowered to introduce their own influences and impacts into all walks of life that has generated our need to develop 'hybrid' '*arithmoi* of significances' that bridge between the two (discursively polyvocal terms and formally univocal terms).

A more sophisticated case of hybrid *arithmoi* of significances would be the use of the Rothman Index that helps "Identify at-risk patients sooner for earlier intervention with predictive, real-time clinical surveillance solutions." It does this by *incorporating qualitatively rich nursing assessments based on interactions with the patient* into a combined measure also including lab results, vital signs, diagnoses, etc. “The result is a continuous measure of patient condition, integrated into the EHR [Electronic Health Record] computed on a real-time basis across all conditions, diseases and care settings.” It augments a “more scientific” statistic composed of strictly object measures:

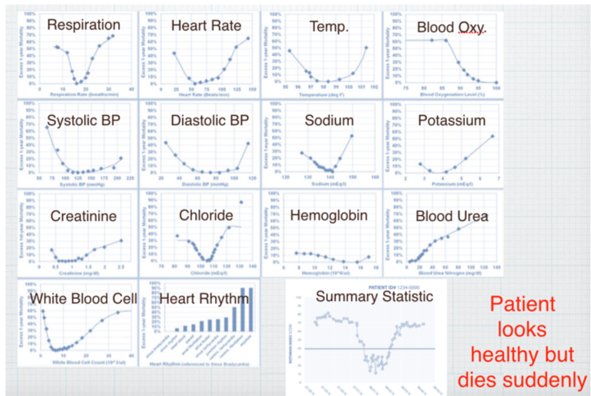

Fig. IV-1: Objective Patient Well-Being Index

In contrast the Rothman ‘*arithmoi* of significances’ pulls all the quantitative and qualitative data sources into an enhanced kind of patient chart, a graph of changes in the patient’s Rothman scores over time. The chart below indicates a dramatic downward change in patient health that would have been missed without the nurses’ qualitative assessments: [2]

[2] Theresa Brown, “How to Quantify a Nurse’s ‘Gut Feelings’ ”. *NYT*, August 9, 2018. URL: https://www.nytimes.com/2018/08/09/opinion/sunday/nurses-gut-feelings-rothman.html?algo=als1&cmpid=73&module=newsletter-opinion&nl=personalization&nlid=1971203&rank=1&recid=18cMVQhRBuhIYcRe0ew90M9f2Dp. Also: PeraHealth, URL: http://perahealth.com/page/scientific-model, and “For a graphic presentation see, URL: http://cdn2.hubspot.net/hubfs/1775295/Posters/PRESENTATION_8_-_stanford_seminar_v3.pdf .

See also, Grindler Katonah 1999a, and Grindler Katonah and Flaxman (1993).

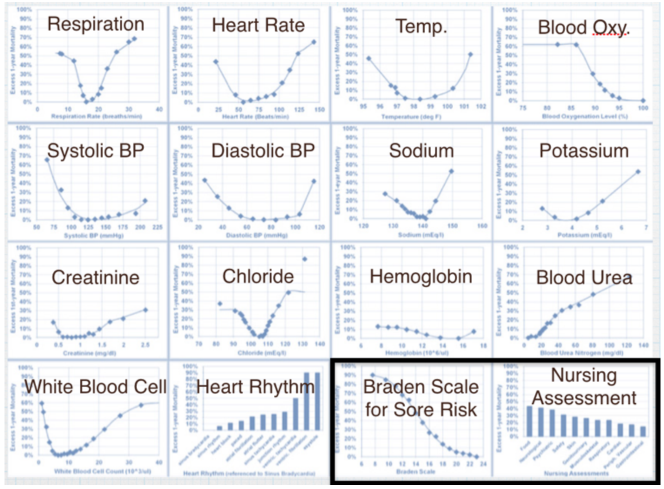

Fig. IV-2 Rothman Index Summary including "Quantifying A Nurse's 'Gut'"

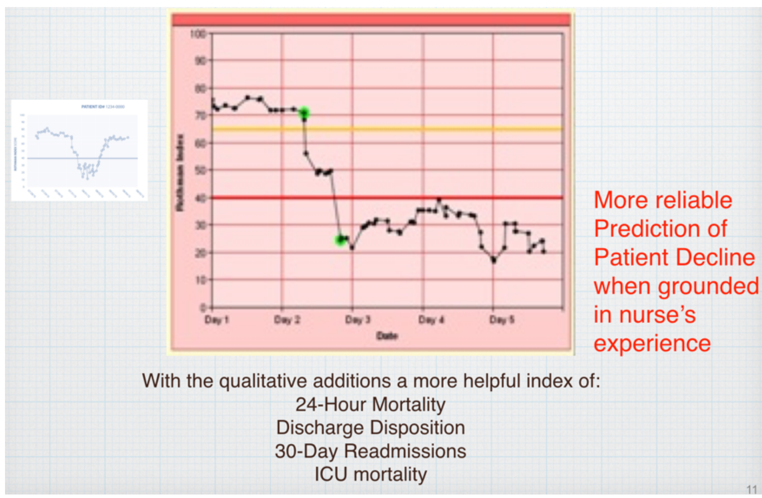

Fig. IV-3: Rothman diagram of Quantification including nurses' qualitative observations
SOURCE: Rothman Healthcare, URL https://en.wikipedia.org/wiki/Rothman_Healthcare.

It is reasonable then, to posit that natural language discourse also allows for *productive ambiguities* akin to those of scientific theories and mathematical axioms, i.e., ambiguities that serve to shape and sustain coherent new thinking and problem solving rather than undermining and preventing them.

These two cases of *arithmoi* of significances illustrate how qualitative experience can be incorporated into mathematical measures. It is in that sense that I will now refer to this synthesis as '*arithmoi* of hybrid significances.' In our computationally rich world, there are a large finite number of such scientific and technological incorporations often of great complexity, such as Google's search algorithms, that seek to promote usefulness in searching for what other people have found significant for a given search. However, such hybrid measures of significance do not as yet, and may never, capture the larger cultural (moral, social, political) impacts and influences of formal systems and their technologies that emerge through our uses of them. Thus, we need to be able to take full advantage of extended natural language discourse to make those kinds of cultural impacts accessible to widespread understanding and neoteric renormalizations of individual habits, community mores, and systems of laws and institutions – that is, the very cultural impacts brought about by modern science and technology. Aristotle's *arithmoi* of phenomena *as actually experienced by living beings* were already available 2,300 years ago for knowing the phenomena, but under much more local cultural and temporal constraints; his *arithmoi* of phenomena provide much of what we find so commonsensical in his philosophy today. Of course, Aristotle was not alone in such achievements: there have been many truly worthy polyvocally argued discourses across histories and cultures.

I am arguing that having rigorous exegetical case studies of argumentatively productive ambiguity would help ground the deep cultural work that our scientific advances have made necessary by bringing out the humanly experienced significances of those advances and transforming them into higher-order cultural stabilizations expressive of *life-form universals*. Generalizing from Aristotle's 'structure of inquiry' (Dewey 1938, part II) for differentiating poetic species, we need to be looking for ways to: select and bring out the phenomena of life-form experience; constitute them conceptually; order or rank them in degrees of excellence; arrange them according to their plurality of explicit and implicit valuations within their coincident ordering; and organize all of this into a principled whole of discourse aimed at a humanizing goal or purpose such as sustainability.

Aristotle's scientific procedures can serve to provide a 'structuring standard' of polysemous terms *and* polyvocal discourse for the conduct of neoteric inquiries into cultural reformulations to establish proper aesthetic pleasures for our current situations and conditioning circumstances, pleasures that help to heal conflicts and relieve injustices. Aristotle's exemplar provides a structuring standard that requires both the explicit evaluation and the purposive aim of enabling proper pleasures. We have no morally and politically effective choice but to do so for the purposes of transforming existing cultural values into "epistemically virtuous and culturally humanizing satisfactions." Such transformed *satisfactions* would be <u>teleological completions for comprehensively sustaining life-form flourishing</u>, *transformations* that are both made possible by scientifically grounded 'epistemic virtues' (Daston and Galison 2007), and made necessary by the very same scientific achievements that have now so evidently produced cultural situations in need of the recovery and reconstitution of harmonized cultural norms and mores.

The exercise of epistemic virtues can further scientific research but such activity is not in itself constitutive of moral and political norms. Moving from particular scientific "is's" to a plurality of cultural "oughts" remains an additional challenge and responsibility that requires different modes of synthetically producing integrative and coherent societies. Changes of the qualities of nature presented and the affordances to nature that they have provided have undercut our prior moral virtues and practical wisdoms. These innovations have thereby introduced unformulated moral relativities and destabilized political constituencies into, at this point, an amorphous global culture mass, which has vast possibilities for dangerously unintended consequences, as disparate groups reify monocultures into falsely bounded silos of "ultimate authority" and "absolute truth," be they scientific, intellectual, religious, or *technological* that reductively externalize the wider processes of group selection for all life-forms that is constantly taking place. However, that very shapelessness of human cultural variation, with its greater degrees of freedom above 'teleonomic' and 'teleomatic' behaviors, is also a diversely creative resource.

How, then, might we characterize a more generalized ground for a cultural "telic turn"? One way would be to generalize from Aristotle's identification of 'imitation' as a human universal that connects all of poetic-making across the range of human potentials. Following some of the historical variation in how people have organized poetics over time, we can look to identify additional humanly universal capacities. For all its dangers, this turbulent resource of global culture can be productively transformed into providing humanity with opportunities to rework prior moral commitments and systems of justice into more determinate variations of human universalities such as can be realized through our species-wide capacities for imitation, imagination, expression, and improvisation.[3]

Another needed approach would be to make use of modern cognitive science and all that has recently been discovered about human cognition. When exercised and made concrete in cultural productions, such *capacities* can become more adaptive within established communities as well as shared to mutual benefit across cultural differentiations. Much as Plato observed in the *Republic*, humans as citizens are free to exercise such creative capacities for good or for ill, whether it be in art, action, or knowledge. As Dewey puts it in our "enlightened" times, the

[3] McKeon (1954) would call these human capacities "themes" for organizing and developing cultural productions. See the essay on "Imitation and Poetry," pp. 102-222, and throughout that book.

qualities of nature presented and the affordances to nature provided by science and technology have "of necessity tremendously modified the conditions under which human beings live and act in connection with one another, whether the conditions be those of interchange and friendly association or of opposition and war. … *Instead of science eliminating ends and inquiries controlled by teleological considerations, it has on the contrary, enormously freed and expanded activity and thought in telic matters*." (1938, p. 391; see longer quote above pp. 41-2.)

I am using Aristotle's scientific discourse as an exemplary case of an argued discourse built on productive ambiguity densely at work in the beginning two sentences of the treatise and carried forward throughout the science. My intent for providing an exemplary case is to reinstitute the qualitative organizing powers of natural language as a source and locus for finding and concretizing principles of art, knowledge, and action. I claim that the opening two Greek sentences of Aristotle's *Poetics* are *productively ambiguous* in their discursively laying down the polyvocal foundations of poetics as a science of imitative making itself by means of polysemous technical terms. However, exhibiting or demonstrating that expressive power is not easy. It requires returning to the same words and phrases multiple times with different conceptual frames and procedural interpretations so as to disclose the power and coherence of the knowledge of poetic knowing in its wellsprings.[4] Uncomfortable as it may be, in practice this amounts to re-entering the text at the same "spot" many times. In addition, making re-entry productive necessarily involves a higher-order search for what holds the underlying ambiguities of the text together, binding them into a coherently generative principle. Anything "higher-order" in the

[4] This interpretive practice is another direct application of Wimsatt's (2007, ch. 6) methodological concept of "false models lead to truer theories," now in the context of direct expressions of lived-experiencing.

argument tends to be confusing until things sort out through repeated encounters, or do not sort out through repeated testing with both intellectual boldness and moderation.[5]

The Opening Two Sentences as Productively Ambiguous

In this case of the opening two sentences of the *Poetics*, the first interpretive observation is that most of the terms in these two sentences are metascientific in the sense that concepts such as the "genus-species relationship," "capacities," "parts," and "primary facts" are applicable to multiple different Aristotelian sciences. So, from the very start, Aristotle's *Poetics* must begin by transforming such "meta" terms into their specialized significances within poetics. The concrete theoretical contents and special phenomena appropriate to a single science must be adaptively grasped through these metascientific terms in such ways as to provide the ordering principles or *arche* for the science as a whole *and* some indications of what the proper methods for conducting

[5] Such a concerted focus on the two sentences in question brings out quite sharply how Richards' concept of the "time of narration" (1992, p. 32ff.) takes on interesting adaptations. In this instance, on the side of the text there are several "times of narration" or discourse at work. First there is the textual extent of two sentences. In a quantitative view of the text as a whole, these are but a blip. On the other hand, with regard to their effects on the argument, their scope of discursive time is the entire text as a whole because these apparently cryptic beginning sentences set up the entire conceptual framework for poetics as a science, i.e., its principles. Moreover, their interwoven scientific terms establish an argumentative order or sequence that is itself a temporal measure and structure of argument enacted as the text undergoes multiple stages of applying different scientific techniques. At root this larger discursive time span is possible only because the two sentences are 'productively ambiguous' in that they provide the unfolding coherence for everything stated. On the side of the close reading process of constructing the exegetical narrative, there is also a temporal complex in which it may take quite varying amounts of exegetical effort to a) simply grasp and understand the text; b) then to develop that understanding into a new discourse giving a constructively layered account of the text; and c) in that process take advantage of later insights that serve to better construe earlier parts of the text. Again, since this text is herein embedded in several historical narratives including that of different numeracies; contexts of connective significance such as a changing appreciation of Tragedy and our current cultural problematic for science, technology and culture; and the emergent relationships between artificial language and natural language exposition, there is an entire manifold of times of narrative significances generated.

or expounding the science will be. Moreover, the range of subject matter phenomena and their causal origins or sources must also be determined for the science to proceed. The interpretive problem then is how to disclose how Aristotle's text does all that in two, rather cryptic, sentences. With this perspective in mind, we can return to the text now, with a renewed interest in how Aristotle "saves the phenomena" of poetry through his application and adaptation of his metascientific concepts and methods, such as causal analysis, to the unfolding of this specialized productive science as *logos* of the *technê* of *mimêsis poíêsis*.

I will fully assume that the scientific method of poetics is concretely instanced and recoverable in Aristotle's full-throated use of the powers of natural language discourse in the *Poetics* as a whole. For the sake of such detailed and explicit recovery, the exegesis will develop new methods of interpretation based on a two-fold strategy of bold 'heuristic reconceptualization' up to an abducted "conceptual analog" that is moderated by tightly matching with the entextualized ideas, and a slowed down process of 'procedural reenactment' that traces connective significances as they emerge and develop a functional network across multiple levels of discursive granularity from *micro* to *meta* scopes of syntax, semantics, and pragmatics.

We can preview this reading for its high points in order to capture an overview of Aristotle founding a science in *practice* by turning to the conceptual and empirical beginnings that Aristotle lays down in Greek sentences 1 and 2:

> *Greek Sentence 1 (S-1).* [1447a8] Our subject being Poetry (*poiêtikês a̓utês*), I propose to speak not only of the art in general but also of its species (*ei̓dôn a̓utês*) and their respective capacities (*dunamin*); of the structure of plot (*muthous*) required for a good (*kalos*) poem; of the number and nature of the constituent parts of a poem (*póswn kaì poíwn e̓stì moríon*); and likewise of any other matters in the same line of inquiry (*methódou*). Let us follow the natural (*phusin*) order and begin with the primary facts (*tôn prôtôn*).

> *Greek Sentence 2 (S-2).* Epic poetry and (*kai*) Tragedy, as also Comedy [and, *kai*] Dithyrambic poetry, and most flute-playing and (*kai*) lyre-playing, are all, viewed as a whole (*tò súnolon*), modes of imitation (*mimêseis*). But at the same time they differ from one another in three ways, either by a difference of kind in their means, or by differences in the objects, or in the manner of their imitations. (Bywater trans. with restoration of a dropped "*kai*.")

In the conceptual and methodological "markup" for these two sentences that results from my exegesis according to 'heuristic reconceptualization' and 'procedural reenactment', I indicate that as an integrated pair, they establish six starting points expressed by Aristotelian *scientific terms* for the whole of the productive science under the pattern of:

[kind of starting point] – [scientific term]:[6]

i)Theory – genus/species relation, *poiêtikês aὐtês/eἰdôn aὐtês*
ii) Method – same line of inquiry, *aὐtês esti methódou*
iii) Central Substantive Term peculiar to the science – Plot of an imitative work, *muthous*

iv) Imitative Phenomena – Epic poetry and (*kai*) Tragedy, as also Comedy [and, *kai*] Dithyrambic poetry, and most flute-playing and (*kai*) lyre-playing
v) Imitative Capacities as Causal – differences of kind in their means, or by differences in the objects, or in the manner of their imitations
vi) Central Embodiment Term – poetic artifact or concrete, composite whole, *tò súnolon*

and all discursively bound together by the logic or *logos* of the productive science as a *techné* of Poetic Imitation (*poiêtikês aὐtês … mimêseis*).[7] These six terminological indications of "Theory," "Method," etc. provide discursive affordance "tags" for the reader's own approaches to a higher order understanding of what grounds and provides coherence to Aristotle's productive science and how it is expounded.

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[6] See the methodological parsing of *Poetics* (1-6) on pp. 24-31, for the opening chapters of the *Poetics*.

[7] '*Poiêtikês aὐtês'* and *'mimêseis'* identify the science, and are only defined by the treatise as a whole in accordance with Aristotle's use of a strong scientific dialectic (*Top. i.* 2. 101a30-b4) in sharp contrast to the modern demand that terms be predefined before exposition.

Aristotle first sets up the *theory* of genus/species relations in the opening of Greek sentence 1 (S-1) with the phrase "Our subject being Poetry (*poiêtikês ȧutês*), I propose to speak not only of the art in general but also of its species (*eἰdôn ȧutês*)." He then appears to give something of a laundry list of topics or subjects to be treated in the science including the capacities (*dunamin*) of the species (and poets), the structure of a good plot, and the number and nature of the parts of "a poem." A straightforward reading of this list as an older way of giving a table of contents is very plausible. And yet perhaps too easy. Is there perhaps a higher order significance to this "list," one that amounts to the statement of the scientific *method* of poetics? The next grounding phrase of "and likewise of any other matters in the same line of inquiry (*methódou*)" is really ambiguous. Does *methódou* indicate just a sort of expanded *et cetera,* or actually a much deeper indication of what the "list" really means as an ordered sequence of scientific techniques? Or both at the same time? My claim is that Aristotle's reference to "the same line of inquiry (*methódou*)" provides a deep structure to the sequence of the list that corresponds to the different kinds of scientific techniques required to achieve knowledge of each of these items. That is, it gives the Method of poetic science as a sequence of technical treatments of poetic phenomena.

Taken serially, this sequence includes three technical treatments. First, the phrase "and their respective poetic capacities (*dunamin*)" coupled with the idea of a genus-species relationship entails a specialized technique for the differentiation of all the poetic species. When coupled with the causal determinations of the three categories of poetic powers or capacities that the poet's imitating uses to create poems as scientific origins in Greek sentence 2 (S-2), this phrase sets up a method of causal differentiation that extends from chapter 1 through chapter 5 of the text. Secondly and similarly, the phrase "of the structure (*sunístasthaí*) of plot required for a good (*kalos*) poem" indicates a specialized procedure of varying the syntheses of different incidents from chapters 7 through 22. A third technical treatment consists of determining "the number and nature of the constituent parts of a poem." It requires an analytic method for comprehending the scientific definition of Tragedy as a species-itself constituted by a system of six functional parts in chapter 6.

At this point in S-1, two sequential anomalies or questions appear. First, we are not entirely sure where to place the determination of the more specialized parts within plot (discoveries, reversals, and sufferings) as the "soul" of tragedy. All we have in S-1 is the single mention of the specialized content term of "plot" (*muthous*): a single mention that appears to have two coincident interpretations, viz. as a new unity within the species of Tragedy itself after the definition, and as something that requires an extended synthesis in chapters 7-22. Yet the list puts "plot" and its synthesis <u>before</u> the analysis of parts that is included in the definition. As alluded to above, the resolution of this anomaly lies in the higher order functioning of plot: on the one hand, as exemplary of Tragedy as a whole, and of Poetry as a whole with Tragedy being the Best species, and on the other hand, as the inner driving forms for the exposition of tragic synthesis in 7-22.

In S-1, the second sequential question is what to do with the closing phrase of "Let us follow the natural (*phusin*) order and begin with the primary facts (*tôn prôtôn*)." Where does this phrase lead us to? What does a "natural order" amount to, and what constitutes the "primary facts" we are to begin with? My claim here is that as a first step in the "same line of inquiry," the natural order amounts to starting with the central phenomena of poetics-itself, namely some range of constitutive species, and that the "primary facts" are indeed the three kinds of poetic capacities that serve as origins for artistic causation of imitations available to poets and experienceable by audiences. We thereby have a clear pair of connectives from S-1 to what is laid down in S-2: a range of constitutive species and the causal origins for artistic imitations and the capacities or powers of the species of imitative art. (Additional procedural techniques can be identified beyond chapter 6, but that is beyond the present scope.)

Overall, then, S-1 is 'productively ambiguous' in two respects: in its laying down metascientific terms that will be adapted to the specialized properties of poetics-itself and all its included phenomena, and in its two coincident interpretations of "table of contents" and "sequence of methods" which provide a higher order coherence to the exposition of the science. For a genuine science is not merely a list of topics to be casually explored, but more complexly a tightly coupled sequence of scientific techniques that must be followed in a determinate order: differentiation, definition, analysis into parts, synthesis of good plots, and any remaining issues needing to be resolved such as the proper modes of criticism.

Greek sentence 2 does not disappoint. Without any further ado, it begins with a list of well-known and naturally (endogenously) occurring species of Greek poetry: "Epic poetry and (*kai*) Tragedy, as also Comedy [and, *kai*] Dithyrambic poetry, and most flute-playing and (*kai*) lyre-playing." Again, is this simply an artfully arranged list, or does it have a higher order organization? Or both? Aristotle makes very clear that both meanings are involved, since these species "are all, viewed as a whole (*tò súnolon*), modes of imitation." This collection does not turn out to be a haphazardly pleasant list. It is actually a highly nuanced conceptual grouping composed of three meaningfully chosen pairs of species: "Epic poetry and (*kai*) Tragedy," "Comedy [and, *kai*] Dithyrambic poetry," and "most flute-playing and (*kai*) lyre-playing." In short, this group provides phenomenal evidence of three primary kinds of differences in poetic capacities or powers that can be observed: "they differ from one another in three ways, either by a difference of kind in their means, or by differences in the objects, or in the manner of their imitations." This group of species is an instance of an '*arithmos* of phenomena' of "six" that we have already noted several times. Those fundamental differences in powers turn out to be ones of what does the artist imitate "in" using certain means or media, on what basis does the artist separate out the actions imitated appropriate to their chosen species or "objects" imitated, and how does an artist end up with a definite style or manner of imitation. These differences are not only presented by imitative poetry, they are also different powers or capacities for poets to imitate through. These three differences in powers of poems *and* capacities of poets are three categories of the "primary facts" or causal origins of poetics in human experience. Without going any further into the details of how these comparative *and-ed* and contrasted *or-ed* pairs develop into organizing examples for all of poetry, the key point is that each pair helps us notice fundamental differences (or contrasts) and correlative similarities between the members of each pair, and across the grouping of three pairs as a whole that functions as exemplary for all poetic powers. (See Appendix A for more details.)

However, we encounter another deep ambiguity in S-2. What is it that ties all the species, individual poems, and characteristic organization of a work of art together? Here we find the apparently ordinary phrase of *tò súnolon* that Bywater translated as "on the whole" and others as "generally." Those translations rather miss the central work that this technical term does; Aristotle assigns it to structuring all the entities of the science. A better translation would be "concrete, composite whole" (Telford 1961), for that is what an artistic artifact is as a *thing*. The higher order ambiguity here is that many aspects of poetics constitute such concrete, composite wholes. The *Poetics* starts with the group-of-six species, which "on the whole" constitute a concrete, composite grasp of poetics-itself. But it goes on to include: 1) each species as such, 2) each individual poem or work of art as such, 3) the structure of a plot which is coincident with the poem, and, again, 4) the unity of the highly organized grouping of six natural species that together are expressive of a full range of causal origins for poetic "substance." It may even extend to the discursive unities of the *Poetics* as a whole.

In sum then, we have six expressions of <u>terms</u> as beginning points or principles (*arche*) in the (i) *theory* of genus-species; the (ii) *method* or sequence of scientific techniques constituting the method of the science; (iv) *imitative phenomena* given as a fixation of the natural phenomena of poetic species; and a determination of the unifying v) *imitative poetic capacities as causal* for poetics-itself, along with all as transformations of metascientific terms into the foundations of poetic science. Moreover, we have the most important *substantive term* in poetics, i.e., (iii) "*Plot*," given central importance as it will be thematized throughout much of the treatise, as well as the creation of a technical sense for the kinds of things or *embodiments* that poetics deals with – that is, vi) *concrete, composite wholes*. My claim is that these six beginning points are *productively ambiguous* in their implicit powers for organizing and developing the whole of poetic science and most importantly facilitating the artist's synthesis of good/noble plots. Those implicit powers stem from Aristotle's advancement of *logos* into a scientific mode of discourse in which numeracy stays joined to phenomena without losing either its combinatoric generativity or its attachments to the appearances of phenomena.

To reiterate, the obviously cryptic obscurity of the first two Greek sentences is actually a masterful exposition of the coincidence of both the concepts of 'poetics-itself' with subject matter 'species-themselves' laid out in S-1, which are fulfilled with concrete phenomena and tied to their different causal origins in S-2. However, S-1 and S-2 do a lot more foundational work. Along with the theory of genus/species cashed out in phenomena and causes in S-2, Aristotle also determines a sequence of scientific methods for treating the subject matter in S-1 as a sentential whole. This sequence of scientific procedures is a discursive mode of enumeration. In this sequence, each such topic requires its own scientific technique, e.g., "differentiating" the respective species capacities in chapters 1-5. That is, S-1 doubles up the expression of two reasonable significations[7] – as it also expresses both a "list of subjects to treat" (i.e., species-themselves, parts of a poetic making, etc.) *and* "a sequence of scientific methods to be applied to those subjects" (differentiation of poetics into species, analysis of the parts of species, the structuring a good poetic plot, and further problem resolution). These doubled significations are simultaneously expressed in a single utterance. The surprising result provided by this doubling is that Aristotle's scientific method or "line of inquiry" (*methódou*) can also be given in what appears to also be a straightforward verbal sequence of topics to treat.[8]

The key interpretive point is that the first Greek sentence of the *Poetics* is not an isolated sentence simply stating a proposition, or even a small finite number of propositions. Rather, S-1 is the principled beginning of for the theory and method of the whole scientific discourse. This higher order coincidence of Aristotle's language use actually codifies Aristotle's ramifications of multifarious significances. S-1 also introduces the first contentful scientific term, viz. 'plot'

[7] I am not referring to readers bringing different interpretations to the text, but rather to the expressive achievement of entextualizing multiple significations in the text itself to be discovered by readers. As such it is a *positive* instance of syntactic, semantic, and pragmatic ambiguity, or amphiboly, which argumentative discourse makes possible. I am not arguing that my particular wording for this multiple signification is definitive. My claim is that Aristotle's sentence is intrinsically polyvocal, regardless of how that gets explicated into multiple significances for what the sentence says. And that it is precisely the depth of such productive ambiguity that makes multiple interpretations both possible and worth having. Interpreting any text without productive ambiguity soon runs aground in simplicities.

[8] It will turn out that after close exegesis, this claim of listing a *linear* table of contents is not quite correct in that there is no one way to place "plot" in the actual development of the text according to the traditional chapter divisions inserted by some editor. In that way, the first sentence's very ambiguities about the *order of treatment* for the specialized term "plot" work to express the wellsprings for developing both the argument of the science as a whole that on the one hand establishes the higher-order architectonics of "plot" as the part that is the soul or life-form of tragedy in chapter 6, and on the other hand, *also* grounds making the modeled synthesis (*sunístasthai*) of plot a separable scientific task in chapters 7-22.

(*muthos*), as the central substantive term for expounding the whole of poetic science, with the other terms being primarily metascientific terms, e.g. “number and nature of parts,” yet to be explicitly adapted to poetics-itself, which is the name for this science. Moving forward, we find the further productive addition of S-1 being intrinsically paired with the phenomena and causal origins laid down in S-2 as we extend the discursive scope.

Greek sentence 2 carries different aspects of these principles forward by completing the *theory* and *method* of the first sentence through the determination of the *phenomena* of poetics – epic and tragedy, etc. – and their three *poetically causal origins* – the means, objects, and manners of imitation – as “first things according to nature.” S-2 does this determination in two different senses: naturally occurring poetic phenomena *and* three of the most basic aspects of all such phenomena in capacities natural to humans – those of using imitative materials to imitate actions with definite styles or manners. Accordingly, Aristotle initially couples the theory and method with a functionally coherent phenomenal system (*arithmos*) of six species of imitative art that empirically captures the diversity that had already burst forth into the classical Greek period of creative expression. These six species are “first” in the sense of being actually occurrent phenomenal presentations that must be saved: this is a first in the “order of experience.” In the second sense of “first,” at the end of S-2, he then ties in the *noetic determination* of the “first things” or primary origins in nature of a complete domain of imitative making to their resultant phenomena through their *causes* already at work in this poetic activity. This is first in the “order of science.” The “system of six” species actually manifests a theoretically foundational or basis set of the primary causal phenomena already at work in them, but now organized according to Aristotle’s four-causal analysis. Thereby, after the first two foundational sentences, the system of six is also a phenomenal basis set for the *arithmos* of species differentiation through causal differentiation next in the sequence of scientific techniques.

To better see the relationship between the exemplary group of six species and the three causes specified, we can turn to how Aristotle uses the actual species phenomena brought into relations with a functional system of causal oppositions to capture the primary facts in their manifest characters of: means => [visual | oral], objects => [noble | base], and manners => [dramatic | narrative] in chapters 1, 2, and 3 respectively. He simultaneously differentiates these causal precisions to procedurally cash out their productive ambiguity so as to allow multiple discursive rearrangements in the flow of argument, even as he coincidentally develops the phenomenally precise science of their behaviors and functional relationships in the different species. This functional system allows the poetic functions of the causal precisions to have free play in the process of differentiation, so as to allow the three most imitative and beautiful species of Comedy, Epic, and Tragedy to gradually emerge and sort themselves out as such by the end of chapter 3. In chapters 4 and 5, he then reorganizes that tri-function causal network developed so far according to two causes (*aitiai*, 1448b4) which are humanly universal instances of Learning (*mathéseis*, 1448b8) and Delight (*xairein*, 1448b8).[9] Only subsequently in chapter 6 can catharsis

[9] At his discursive best, Aristotle always provides additional nuance. Aristotle firmly pins down the context of teleological causation in the human universals associated with imitation, viz. Learning and Delight, at the beginning of chapter 4. He also finds another human universal in material causation – our shared enjoyment and production of harmony and rhythm later in this part of the text is also "natural":

> Imitation, then, being natural to us—<u>as also the sense of harmony and rhythm</u>, the metres being obviously species of rhythms—it was through their original aptitude, and by a series of improvements for the most part gradual on their first efforts, that they created poetry out of their improvisations. (1448b20-23, underline mine.)

Once this third commonality is noticed, it can serve to identify another instance of "the minor third" nuance when it comes to the modes of catharsis. Aristotle puts the catharsis of pity and (*kátharsis*) be captured as the proper function of the three species, and especially the best, Tragedy. As noted above, that telic reorganization then gives us a fourth pair of primary facts: proper pleasures => [learning | delight] to complete and fulfill the causal differentiation of species according to purposes.

Not all of this is strictly qualitative nor entirely innumerate. The discipline of an <u>*arithmos* of the manifest phenomena</u> captures numeracies by the causally comprehensive six species that puts the phenomena and their active interrelations first and foremost as the substantive ground. As a concrete example from chapter 1, note how there are *three* separable means of imitation – rhythm, melody, and verse – and that they can be combined in *two* different groups of species:

> There are, lastly, certain other arts, which combine all the means enumerated, rhythm, melody, and verse, e.g. Dithyrambic and Nomic poetry, Tragedy and Comedy; with this difference, however, that the three kinds of means are in some of them all employed together, and in others brought in separately, one after the other. (*Poet.* 1, 1447b26-29.)

Furthermore, if we consider instances of three *arithmoi*, namely, the *four* causal differentiation, the *six* exemplary species grouping, and the analysis of *six* parts of a Tragedy together, we can see that many numerable aspects are involved as well. Such *arithmoi* are multiply determinable depending on the technique and context of their organizing phenomena. As we have seen, Aristotle adapts the functioning of an "*arithmos* of six" in two different contexts with different

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fear first and foremost as a higher-order unifying of experience in chapter 6. It is not until chapter 11 that he lets the "minor third" drop:

> Two parts of the plot, then, reversal and discovery, are on matters of this sort. <u>A third part is suffering</u>; which we may define as an action of a destructive or painful nature, such as murders on the stage, tortures, woundings, and the like. The other two have been already explained. (11. 1452b10-1452b13, underlines mine.)

Here the causal origin is the efficient causation of Spectacle.

phenomenal contents. He first explicitly uses the "*arithmos* of six" in S-2 to organize the system of six basis-species. And he re-determines it in chapter 6 where he formulates the by then essential functioning of Tragedy as a higher order system of six parts: [melody | diction | character | plot | thought | spectacle] for a single species. Putting these two determinations together with the more overt first-order capture of the surface presentations of the poetic qualities of Epic and Tragedy, Comedy and Dithhyramb, and Flute and Lyre playing, we can just glimpse how it is not the number six per se, but rather some <u>determinate functional relation of the phenomena</u> to be captured according to technical context and purpose.

This analysis of *arithmoi* of phenomena leads us to questions about the whole of poetic science: "What about the functional relationships for the whole of poetic science itself?" "Is there a functional unity to that whole as well?" Furthermore, what is the "substance" or primary object of the science? The entire science is constituted from the dominant unity of quasi-essence that is precisely that of Plot (*muthos*) *and* Artifact (*tò súnolon*),[10] which are brought together by analogy with biology where, just as Plot is to Soul (or life-form), so also is Artifact to Body. The confirming evidence for this interpretation is found in chapter 6 where Aristotle first articulates the six functional parts for all of Tragedy, thereby organizing a body capable of being besouled, and then proceeds to determine Plot as the soul or life-form of all Tragedy as its first-actuality. All the variety of species-themselves are brought to the functional whole of poetics-itself through

[10] "Artifact" here includes performance, and in fact some species of poetry such as Dithyramb and Nome are ephemeral in their existence primarily in the events of such festivals, which are staged but intrinsically improvisatory in the event or "happening" itself. Aristotle does, however, find that persistent artifacts such as plays that can be read as well as staged are fundamentally more the products of art by virtue of being fully authored by the poet.

the activity of the Plot as realized in the embodiment of poetic Artifice. It so happens that the dramatic species are the best realization of this potential.

For a possible emergent third instance, as articulated above, I also posit a highest order "scientific *arithmos* of six" for poetics-itself as a whole that is constituted by the co-functioning of these six founding scientific terms as the system required to ground a single science and its particular substance as a whole. This *arithmos* is a functional system of six scientific starting points: Theory and Method, Central "Essence" (Plot) and Central Kind of Thing (*tò súnolon*), Imitative Phenomena and Imitative Cause. Greek sentences 1 and 2 lay down these six scientific terms as a principled foundation for poetic science as a whole through their *productively interacting ambiguities*. For all of these *arithmoi,* we can see that they are phenomenally self-instancing; that is, they are not reduced to the meaning of "6" or "4," but rather "six" or "four" are presented through the organization of the phenomena manifest in our experience as such that is provided by argument in natural language discourse. These *arithmoi* are not presented as numbers in themselves produced by the successor function, as we moderns would approach formal arithmetic numeracies.

A strange possibility emerges if we pursue one final poetic power, perhaps as satisfying a one as Plato's rigorous irony might indicate – as a philosophic dramatist who cast out poetry from the city for its potential disruption of common sense norms. By looking for the possibilities of a phenomenal ordering by means of an overlapping or "doubling-up" in contemporary knowledge discourse, we enter into a hidden field of significances lying relatively dormant. Given our pervasive expectations of formal rigor as the only mode of scientific knowing, we appear to have cast out natural language as an original medium for capturing and organizing our manifold of new qualities into new integrations of common sense *and* science with teleological coherence and life-enhancing consummatory acts. Might we be able to expand expressive significance rather than reduce it by hybridizing the two expressive modes of qualities and numeracies? To do this expansion would be to recapture Aristotle's *Poetics* as a discursive whole that is itself a teleological consummatory act, not only for an individual spectator or poet, but for the city or community as a whole - by potentially including all the citizens in the world of significances built by Aristotle's productive science, through theorizing potentials for cathartic resolution of conflicts in terms appropriate both for ancient Greeks and even for us today.

The Teleological Character of Nature

At this point, we can see how the re-introduction of "teleological consummatory acts" – in addition to Mayr's biological vocabulary of 'teleonomic' and 'teleomatic' – can be understood in a straightforward way as characteristic of a fully human scientific inquiry in and through the interpretation of Aristotle's discourse. Quite differently from the modern concept of "reverse causation," Aristotle is not positing some sort of mysterious, external to natural phenomena, causal magnet drawing nature to act in non-efficient and/or non-material ways when he speaks of the telos of a substance, the "why" of its existence. Not at all. Rather he is engaged in the fully human scientific activity of understanding and explaining the natures of things as their phenomena disclose their deepest formal substances through empirical science. His sciences reveal how the "first things" present themselves again and again in the conduct of a science that "saves the phenomena." For Aristotle, "nature" includes human nature, and the experiential bond or concrete relationship between audiences enjoying the phenomena of an imitative work of art that is made by a poet who has excellent imitative capacities for creating those phenomena is just "natural" as a property of being human.

For Aristotle, the character of nature is to remain itself in ways that are initially opaque to humanity as we struggle to move from how we initially perceive and understand things "for ourselves" to the point of developing a knowledge of the things in themselves according to their primary causes. We can get stuck at the perceptual beginnings of conducting science by taking all our interests and deep desires to accept our perceptions as immediately true simply because we already think so highly of our own powers in our experience of them. This human struggle to know is what was disclosed in Plato's understanding of the character of Theaetetus' confusion of an eidetic or 'mathematical perception' with knowledge. Plato's Socratic drama helps to relieve Theaetetus' of his "wind egg" mistake for the sake of Theaetetus' tendency towards arrogance-in-knowing, in his relationships with his friends and colleagues.[11] Aristotle's insight into this hubristic "human condition" of intrinsic self-approval is that, contrary to that impulse to immediately believe our given experience, we must struggle to engage with nature in itself <u>again and again</u> until we thinkers have grasped the first principles of the phenomena we experience either for ourselves or in and through our social and cultural activities. Only then can we hope to have solid beginning points from which to capture and disclose the formal unity and stable nature of a given substance and present that knowledge through discourse. We can achieve an

[11] "SOCRATES: Well, then, if you try to become pregnant, Theaetetus, with different things after this, and you do become so, you'll be full of better things on account of the present review. And *if you're empty, you'll be less hard on your associates and tamer*, believing in a moderate way that you don't know what you don't know." (*Theaetetus*, 210C. Benardete trans. Italics mine.) See also the beginning of the dialog – 144E-144B where Theodorus praises the "gentleness," among other qualities, of Theaetetus' character even while describing Theaetetus as ugly like Socrates. In effect the dialog turns this human unkindness around into an understanding that the true ugliness of humanity lies in its ignorance including Socrates' own, while the true beauty available to humanity is that of knowledge, and that without knowledge a person cannot avoid arrogance in interaction with others. This transformation is one way of opening up the possibilities for Tragedy and its catharsis.

objective understanding of nature in-itself only when we engage in empirical scientific inquiry to the point where the phenomena can be re-presented through their connections to their natures as always already at the work of existing. For Aristotle, the “aim” or “goal” or “telos” of a substance is only disclosed through the science’s return to the thing’s essential form <u>in our experiencing of the thing</u> through the phenomenal variations, as presented to us at first in confused and then later according to the primary facts of the thing’s nature.

‘Teleological consummatory acts’ are precisely those acts that bring about *our recurrences to nature through scientific understanding*. Aristotle’s teleology is misunderstood as “reverse causation,” when it is actually a human act of *turning back to nature* for a better formulated explanation of what we experience. Teleologically consummatory acts are a <u>settling into nature</u> through the recurrences of our own activities that captures the complete scope of those activities. The modern perception of strangeness for this phenomenon of goal-determining activity arises out of the fact that in some ways we <u>humans must make our own nature</u> by engaging in those reflective activities, whether as scientists or citizens. We must abduct ourselves into better selves not only from where each of us stands, but also in adaptively theorizing our social, institutional, and cultural framing conditions as a natural responsibility of being human. Thus, “settling into nature” involves adopting or adjusting or changing norms, habits, institutions and all the conditioning circumstances of the situations that we encounter and are active in so that we achieve both knowledge and a reconsolidated common sense sphere of activity—a reconstituted ‘common sense habitat’, whether it be in disciplinary or daily life.

We have forgotten (Erickson, Daston, et. al. 2013) this fact of making our own human nature while we pursue knowledge as if it comes from an “objectivity” completely separate from and outside of ourselves (Nagel 1979, 1986), which tends to present being “objectively” scientific as sufficient to being fully developed as human. With regard to making our own human nature, Aristotle's *Poetics* is astonishingly invaluable because it is a productive science of the human need for such resolutions into nature when that nature is human nature in the city, or in human community with all its variabilities and diversities. Having biologically co-evolved with culture for at least millennia, human nature is incomplete without culture *and* we have to recurrently abduct or "make up" suitable culture (*nous poiêtikês*, *De An. iii*, 4 & 5, esp. 430a10ff; also see footnote 12 below) for it to exist in and for the human flourishing of a given time and community. For Aristotle the primary agent exemplifying such a mode of "active intellect" is the scientist exercising her knowledge in the actual knowing of some object through its phenomena. That Aristotelian claim is still correct today even though modern science has introduced many more tools for the experimental probing of nature and most often using mathematics, which together would have seemed to Aristotle as destroying our ability to grasp things as they are given in experience.

If a scientist disrupts nature, how can she find its stability in nature? If a scientist mathematizes nature, how can she "save the phenomena" of experience? Modern science aims at making objects of thought in "value free" ways for the development of a culture better grounded in natures that are hidden from our unaided perceptual powers. This experimental and/or mathematical inquiry is a *scientific poetics* of a very special character. Moreover, modern science and technology are indeed disruptive as Aristotle would have intuited, precisely because of their undercutting of existing cultural values and norms. This disruption poses deep problems of having to create new cultures to assimilate the new facts and innovative uses of science and technology in ways that consolidate new ways of flourishing. And then all this changes again for the next occurrences of now newer facts and uses with their unprecedented qualities and affordances. We have to develop new arts of "settling in" to or inhabiting such deeper realities as disclosed by current science, even as science itself changes and gets closer to nature; and even as culture must also change around, not only science, but also our very communities with all their qualitative shifts in cultural dimensions beyond science. We have to find ways of adaptively recurring into these freshly disclosed aspects of nature that can be used to build suitable cultures for habitation with the rest of physical and biological nature, and then including our own cultural artifacts as sources of problems. And we have to do it "on the fly" in recognition of the activities of life-forms that Leigh Van Valen labelled the biological driving force of the "Red Queen Hypothesis" (Van Valen 1973) concerning the comprehensive problem of ongoing co-evolution for all organisms in all these dimensions. Life-forms have to "keep running" just to survive with a place in a biological and a cultural ecosystem even as it is evolving.

This degree of change constitutes more variation than Dewey's pragmatism of three intertwined "continuities" of judgment – continuity of experience, continuity of inquiry, and continuity of knowledge – anticipated, or could provide the needed convergence for, through his synthesis of scientific and correlated common sense inquiry in a determinate polity such as democracy (Dewey 1938, pp. 245-246; quoted at the beginning of this Scene, IV). The possibilities for turbulence and chaotic regimes within nature as well as culture are very real: disturbances arising not just from the familiar individual, social, and political origins already shaping events for the ancient Greeks, but also from the accelerating rates of change being induced by scientific and technological innovations – changes with the power to disrupt physical and biological natures in ways far beyond the powers of prior humanity. Both of those sources generate attempts to control through the exertion of force while lacking intrinsic rationality, whether through raw assertions of power or through apparently systematic attempts at bureaucratic regulation. This degree of change also exceeds Quine's picture of knowledge at the end of his "Two Dogmas of Empiricism" (Quine 1953) as changing but stabilized through the core role of formal logic, since that core is not capable of axiomatizing the peripheral qualitative contents in flux.

Oddly enough, the growing computational infrastructure has its own still hidden stabilities and capacities for exercising mechanical expressions of responsibility that are only beginning to emerge, such as the potentials for constant and widespread access to the legitimated facts and the readily available support for "cognitions in the wild" (Hutchins 1995). These hidden stabilities and capacities of computational infrastructure are certainly not yet holistically adapted to human expectations of flourishing across diversities of human community. And they are certainly capable of expressing irresponsible and destructive agencies as well. One can only hope that we can actively design these powerful contributions of science and technology "on the fly" quickly enough to calm things down to a livable stability for the good of life-forms. Such developments certainly will not happen if we simply expect everything will just work out bureaucratically "according to form." These challenges are problems of humanity's in its collective responsibilities for becoming more fully human in ways that make culture afresh and in real time. We need to develop cultural understandings of the powers and disruptions of science and technology well enough to allow us sufficient surplus as varied sorts of people to settle in[12]

[12] Aristotle would say something like: coming to an agreement, a harmony (*sumphwnéw*, συμφωνέω, 1179a17) or "singing with" (*sunadóntwn*, συνᾴδω, 1179a22) our individually true natures as humans according to our own agency by means of habit, and education, and reason – where available – is constitutive of the modes of happiness. Aristotle holds that humanity as a political whole requires social scaffolding to achieve such a community of happiness in its contemplative, active, and private forms. Community in harmony requires legislation that prudently aims at structuring the plurality of the inevitably different individual paths to happiness that come from the different abilities possessed and the different virtues practiced.

through the development of our own excellences whatever they may be and to maintain them within the wider frameworks of virtue without nativistic acts of violence.

Comprehensive Restatement of the Original Problematic as Inclusive of Modern Science and Technology

When looked at from the point of view of further actions seeking resolutions to such problems of change and disruption *while we are all embedded in them*, it becomes possible to see and understand that we need to take all levels of "generative entrenchment" (Wimsatt 2007) from physical to biological to cultural into account as a much more robust account of what our "situation" as human beings actually involves. Starting from the physical world with its forces, regularities, and dramatic occasions for energetic chaos and turbulence that can destroy life-forms "without a care," we are coming to know that we are inevitably included in the matter and energy systems of a vast cosmos that makes it possible to exist and sometimes flourish as we take advantage of local supplies and abundances, while they last. Moving further into that physical situation, we are now coming to understand that we are inescapably enmeshed in the vast ecosystem of earthly life-forms as the comprehensive matrix in which all life-forms coexist and coevolve in a very large finite assemblage of species neither fixed for all time, nor totally fragmented and lacking any localized niche coherences. This assemblage of life-forms is "running as fast as it can" to maintain its overall continuity through a changing complex of all sorts of life-relationships including from predatory to competitive, neutralist, mutualist, symbiotic, to commensal, among others. Just as we could not do without matter and energy, it is also neither possible nor desirable for humans to try to restrict and isolate ourselves from this

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Humans need the stabilities of wisely inclusive and codified laws to flourish together in "cities." (*N. Ethics* x. 8-9) (My thanks to Lucas Tse for helping me to make this connection.)

shifting biological matrix with all its additional dangers, possible benefits, and emergent new forms of life. Not only are individual species generatively entrenched, all of life is as well.

Continuing on in this cosmic swirl of physical and biological change, we are also finding that life itself as a whole has niche habits and habitats, including the behaviors associated with each life-form, which permit relative survival and sometimes flourishing to the point of reproduction. Humans among other species, primate and otherwise, have added even further complexities to our problematic situation through the development of technologies with niche continuities beyond the strictly biological. Learning, communicating, and preserving across generations by an indefinite variety of means of transmission now scaffolds the possibilities for cultural continuities for recovery of past achievements and invention of new ones. These possibilities for instantiating cultural continuities must be aimed at stabilizing the matrix of life-forms in their respective races against time and entropy for continued existence through evolutionary means that are no longer dependent on a mechanically non-emergent material basis. In this even denser complexity, the very concept of generative entrenchment itself becomes problematic as we attempt to modify and secure our cultural heritages through our human capacities for imitation, imagination, expression and improvisation in order to maintain our individual, community, and species viability, even as our own species has become a danger to ourselves and all the rest of life currently existing. When exercised with discipline and art all of these human capacities can be developed productively into teleologically consummatory acts constituting humanly settlings into redeterminations of nature through the recurrences of our own activities.

The problematic of our cultural challenges includes not only the issues of entrenched constraints on our adaptations, but also the overt, abductive challenges and tasks to actively transform and evolve those constraints through changes that re-normalize us into our cultural traditions even as they are changing. We not only need culture to survive; we need to return to our cultural roots and actively adapt them, discarding and acceding components and assemblages as necessary in our varied cultural niches as they exist in a globalized manifold of life. We must make it possible for our biological life-form to flourish, for only flourishing and surplus provide the materials and life expressions necessary for our cultural continuity. We cannot simply toss out or reduce ourselves to abstractions with the mere appearance of infinite coherence; we have to also artfully develop our sciences and technologies from their origins and prior bases so as to keep our entrenchments healthy across the whole of life. There is no returning to the past for any sort of living entity as having permanent stability. As humans, we can only survive and flourish, not by abandoning the past, but by carrying it forward in ways that both change and maintain the wisdoms of our heritages.

Such carrying-forward now entails reconceptualizing ourselves as life-forms existing within an evolutionary situation, one that is constantly changing in its possibilities for continuing to live and survive in an inextricably massive co-existence. The goal is to *re-normalize* our cultures from within under the current large finite conditioning circumstances for life.[13] Re-normalization involves re-inventing ourselves and our culture under changing circumstances, rather than some return to an idyllic past set of norms as reductively absolute. That is, each living entity will have to "reflexively" re-instantiate itself over time and changing circumstances *and* elaboratively "recur" to its entrenched biological and behavioral resources (Wimsatt 2007, ch. 7) in order to re-adapt to those changing circumstances. Only in that way will a living entity be

[13] This goal may seem simplistic, or even naïve or overly idealistic, but that does not diminish its power when reflectively abducted into culture.

truly able to "settle in" to its own life-forms even as they change through the activities of its own life and the evolutionary adaptations over generations with an aim to flourishing where possible under contemporary conditioning circumstances.

Here then we can see a full range of "*teleo-*" activities as Aristotle first determined them through the transformation of life functions as they develop in a sequence across nutritive/reproductive as common to all life, perception by animals, and cognitive life-forms or "thinking souls" that also perceive, eat and reproduce. (*De Anima* books *ii.* and *iii.*) All these kinds of soul, and indeed all the additional kinds of life-forms our science has discovered, have their proper objects to aim at and "organs" to embody these functions. Following Mayr, this proper object could be the expression of a nutritive life-form function such as a *teleomatic* pursuit of a sugar gradient by a microorganism, an animal's pursuit of perceived prey, or a police officer seeking a morning donut to "start the day." Again, it could be a *teleonomic* performance of a consummatory act according to an inherited, yet not entirely determinate pattern of behavior such as an ethological fixed action pattern exhibited by a bird's attempt to return a lost egg to a nest (as Konrad Lorenz identified), or a humanly developed habit that variously structures fight or flight interactions. Or it could be a humanly *teleological* consummatory act performed through a cognitive life-form function such as signing a contract or experiencing a tragic catharsis. Both of these latter acts intrinsically require the implicit multiplicity of cognitive functions natural to human experiencing developed in the relationship between people, their environment, and our individuated cultural "shells" or "nests" or "career goals." In this latter case, across Aristotle's and modern science's kinds of living activities, the wider range of environmental features or properties function to complete an embodied "responsive order" of experiencing (Gendlin

1997b) developed according to individual and social interactions of acculturation.[14] This wider range of environmental features now includes all the powers and artifacts of computational technology that are as yet only emergent and not fully acculturated to our needs for fulfillment and life-enhancing completion rather than life-disrupting turbulence.

The specialized aim or purpose of poetic science is the catharsis of the human need and desire for resolution in the particular as well as universal conditions and the varied circumstances of each of us living our lives. For Aristotle's time and culture, the aim of Tragedy was the catharsis of the suffering of living and the stresses of human pity and fear in a technologically simpler, yet profoundly uncertain world of natural and human events. The *Poetics* is also the discourse that gives the foundational formulation of poetry for his time and the idealizing formulation of Tragedy, and yet this idealization is still open to the vast variations and changes of our contemporary times. The possibilities for tragedy still exist. The aim of modern specialized science is towards the making of new knowledge in order to open up previously undisclosed or unknown aspects of natures of all sorts. Here then is a full analogical circle between biology and poetry as Aristotle first articulated it by asserting plot is the soul of tragedy. It is the reflexive relationship between plot as the life-form of poetics *and* science as producing or making new possibilities for life-forms within the human biome with all their risks and opportunities. That is, the complex relationship between "the science of poetics *and* the poetics of science."

Returning to Aristotle's Principles for the Science of Poetics as Productively Ambiguous Discourse with the Potential for Inquiry into Fresh Resolutions of the Poetics of Science

[14] My thanks to Parysa Mostajir for clarifying this specifically human mode of receptiveness to experiencing, and to Ted Steck for insisting on a continuous science of biology across all life-forms.

As is the character of finding ourselves again as having grown through a prior reading of a great text, we should return to Aristotle's text once more to see where it lies in our experience from our acquired standpoint, and to discern what we are now able to grasp that has passed us by so far. By doing so we may gain insight into how Aristotle's science was able to identify and organize the basic scientific terms of *mimêsis poíêsis* as beginning points for the development of the science of producing works of art as a discursive whole. Building on what I have previously shown about the orderly differentiation of species, the definition and analysis of tragedy, and the idealization of the inner functions of plot, I will seek to disclose that the cryptic character of Aristotle's foundations for poetic science at the opening of the treatise conceals their higher scientific organization, even as they make reading easier for poets not explicitly concerned with scientific precisions.

Returning to the opening of the *Poetics* once more means we will have to add a different viewpoint or voice to our encounters with the text: namely, the viewpoint we can have on *our experience of reading the text*. This strange viewpoint will enable us to not only struggle with what does Aristotle's text mean, but also with what do we experience of our own significances as we engage in that process. This additional viewpoint will enable us to grasp the tertiary qualities of our experiencing in ways not unlike what Dewey brought forward about our experiences of works of art and what Gendlin treats systematically as a "felt sense" that functions in cognition (Dewey 1938, pp. 79 & 124, and 1934; Gendlin 1997a, Ch. II; see my footnotes 21 and 64). Beginning plausibly with Aristotle's explicit scientific terms, we readers nonetheless encounter strangeness in Aristotle's scientific foundations. How could these two obscure sentences found a scientific discourse through productive ambiguity? We have to invite this discursive "stranger" in for conversation; 'ze' might well have something important to share with us that will help us correct our mistakes from where we moderns presently live in our personal, group, and working silos of accomplishment and expertise.[16]

Before sentences 1 and 2 are laid down, the four metascientific terms – Theory, Method, Phenomena, and Cause – are not yet tied to poetics-itself and its species-themselves. And yet, in the abstract, we can notice that Theory *and* Method, Phenomena *and* Cause would have to coincide as pairings in the exposition of any specialized Aristotelian science as such. Moving from metascientific beginnings to subject-matter beginnings, we have a third pair that also have to coincide: Plot (*muthos*) *and* Artifact (*tò súnolon*). Together this pair of terms constitutes a [formal | material] unity with relationships between them as two "substantive" terms: "Plot" and "Concrete, composite whole" or poetic artifact. In the actual works of art, i.e., the imitative substance of poetics-itself, these two must be the "same thing" as form *and* its articulated matter. That is, the reality of a work of art is that it is a functional whole with a performatively essential plot or action that is unified by the co-functioning of all its parts, and that is less a work of art for lacking any of this.

First remember that, <u>Aristotle has to achieve logically rational ordering *behind* grammar in his arrangements of Greek words through discourse</u> (p. 149). Now we can make the strange observation that this whole pattern of six terms grouped into three coincident pairs can have a higher-order organization. Each pair of terms can be consolidated into a single term, and

[16] In an evolutionary cultural adaptation of the modern natural language of English to express a gender neutral pronoun, "ze" has been abducted into common conversation in order to provide a more inclusive mode of speech at a higher level of universality than the historical gender traces in English allow. Once the intended strangeness of this new locution passes, the sonorous charm of the linguistic abduction lies in its carrying forward of the tradition of respect for others found in the archaic northern English use of "thee" and "thou." In our times with our more intrinsically diverse human spiritualities, the expression "ze" nonetheless echoes back to the sounds of "thou's" and "thee's".

moreover, with the substantive pair of “Plot & Artifact” occurring twice as a central term in two related significances, this consolidation is oddly similar to a first-figure syllogism in Barbara:

All A’s are B
All C’s are A
All C’s are B

If we combine Theory *and* Method into ‘Theory&Method’ for ‘A’, Poetic Phenomena *and* Poetic Cause into ‘Phenomena&Cause’ for ‘B’, *and* Plot *and* Artifact into ‘Plot&Artifact’ for ‘C’, the syllogistic form also works as a discursive ordering or argument scale syntax, as developed through the whole of the science as stated in sentences 1 and 2:

All ‘Theory&Method’ are ‘Phenomena&Cause’
All ‘Plot&Artifact’ are ‘Theory&Method’
All ‘Plot&Artifact’ are ‘Phenomena&Cause’

Of course, such a strange formal associativity between syllogistic validity and discursive scientific knowledge could be merely coincidental instead of substantively grounding. Yet it really is the case that Aristotle’s term logic is also and actually an empirically grounded logic of scientific discourse aimed at “saving the phenomena.”[17] By ‘logic of scientific discourse’, I mean

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[17] An interesting operational example of such symbolic “layering up” from individual terms to a higher order organization comes from a modern computer and social scientist, Herbert Simon. It can be found in *The Sciences of the Artificial*, in a section labelled “Simple Descriptions of Complex Systems” from chapter 8, “The Architecture of Complexity: Hierarchic Systems.” Simon shows how a micro detailed 8x8 combination of 64 symbols:

A	*B*	*M*	*N*	*R*	*S*	*H*	*I*
C	*D*	*O*	*P*	*T*	*U*	*J*	*K*
M	*N*	*A*	*B*	*H*	*I*	*R*	*S*
O	*P*	*C*	*D*	*J*	*K*	*T*	*U*
R	*S*	*H*	*I*	*A*	*B*	*M*	*N*
T	*U*	*J*	*K*	*C*	*D*	*O*	*P*
H	*I*	*R*	*S*	*M*	*N*	*A*	*B*
J	*K*	*T*	*U*	*O*	*P*	*C*	*D*

Fig. IV-4 Simon’s Example of a Hierarchic System

can exhibit an orderly substructure of 4 blocks of a characteristic arrangement of 16 symbols. These 4 blocks can then each be more simply codified as a more specific combination of a 2 x 2 a mode of discourse that is literally constituted through the ordering and connecting done by the very concepts and methods that are used to determine the knowledge of phenomena provided by the science, rather than indirectly referring to those theories and techniques through reporting just the concluding facts of the subject matter.[17]

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pattern of 4 new symbols constructed from the micro symbols that now has a more global scope. He does this by means of hierarchically decomposing the system of 64 symbols down to 4 repeated patterns with their own labels, {*a, m, r, h*}, and then regroups them into a meso-scale ordering, again with its own symbols, {*w*, *x*}, and finally into the highest or macro level 2 x 2 array:

$$\begin{vmatrix} w & x \\ x & w \end{vmatrix}.$$

Simon's procedure with its hierarchical structure is quoted below.

Let us call the array $\begin{vmatrix} AB \\ CD \end{vmatrix}$*a*, the array $\begin{vmatrix} MN \\ OP \end{vmatrix}$*m*, the array $\begin{vmatrix} RS \\ TU \end{vmatrix}$*r*, and the array $\begin{vmatrix} HI \\ JK \end{vmatrix}$*h*. Let us call the array $\begin{vmatrix} am \\ ma \end{vmatrix}$*w*, and the array $\begin{vmatrix} rh \\ hr \end{vmatrix}$*x*. Then the entire array is simply $\begin{vmatrix} wx \\ xw \end{vmatrix}$. While the original structure consisted of 64 symbols, it requires only 35 to write down its description:

$$S = \begin{matrix} wx \\ xw \end{matrix}$$

$$w = \begin{matrix} am \\ ma \end{matrix} \qquad x = \begin{matrix} rh \\ hr \end{matrix}$$

$$a = \begin{matrix} AB \\ CD \end{matrix} \qquad m = \begin{matrix} MN \\ OP \end{matrix} \qquad r = \begin{matrix} RS \\ TU \end{matrix} \qquad h = \begin{matrix} HI \\ JK \end{matrix}$$

Fig. IV-5 Simon's Stepwise Composition of a Hierarchic System. SOURCE Simon 1996, p. 208.

Given that Simon develops this example in the wider context of the concept of "nearly decomposable" systems, it actually allows for greater flexibility in its capture of different qualitative conditions exhibited by phenomenally complex systems. (Simon 1996, ch. 8.)

[17] We can find an explicit statement of such co-constitutive discourse at work in Aristotle's own words as he identifies a sequence of changing causal accounts of the soul in the opening chapters of the *De Anima* Book *ii*, which parallel the pattern of the opening chapters of the *Poetics*, but at a more highly developed level involving interactions between causal categories as grounds for argument. This is a mode of discourse in which seeking a definition of soul or life-form goes through these connected transformations even as it maintains coherence between the different accounts:

> *ii.* 1. Let the foregoing [bk. *i*.] suffice as our account of the views concerning the soul which have been handed on by our predecessors; let us now make as it were a completely fresh start, endeavouring to answer the question, What is soul?, i.e., to formulate the most general possible account of it. (412a1-412a5)
>
> *ii*. 2. Since what is clear and more familiar in account emerges from what in itself is confused but more observable by us, we must reconsider our results from this point of view. For it is not enough for a definitional account to express as most now do the mere

Returning then to a more ancient mode of numeracy, one that Thomas Mann signposted in his recovery of the biblical Joseph's ability to interpret Pharaoh's dreams of seven kine and seven corn (footnote 27, II) but also one that Aristotle made discursively logical for conducting empirical science, we have finally come to a point in our story at which Aristotle's use of numbers, i.e., *arithmoi,* can be properly restated. Aristotle's use of "numbers" in science was one grounded in the powerfully conceptual "counting" of scientific terms as they were doing the work of logic in the arguments of extended discourse.[18] With the above *three* terms arranged in *three* pairs of *two* scientific terms each, we can see an underlying "Threeness" of a syllogism that gives the form of the discursive logic which grounds the specialized science of poetics.

As a *terminologically numerate* logic of discourse, this complex syllogism provides an "*arithmos* with argumentative force" because each of the terminological pairs determines an

fact; it must include and exhibit the cause also. At present definitions are given in a form analogous to the conclusion of an argument; e.g. What is squaring? The construction of an equilateral rectangle equal to a given oblong rectangle. Such a definition is in form equivalent to a conclusion. One that tells us that squaring is the discovery of a mean proportional discloses the cause of what is defined. (413a11- 413a20)

ii. 3. It is evident that the way to give the most adequate definition of soul is to seek in the case of each of its forms [the soul of plant, man, beast] for the most appropriate definition. (415a13)

ii. 4. It is necessary for the student of these forms of soul first to find a definition of each, expressive of what it is, and then to investigate its derivative properties, &c. But if we are to express what each is, viz. what the thinking power is, or the perceptive, or the nutritive, we must go farther back and first give an account of thinking or perceiving; for activities and actions are prior in definition to potentialities. If so, and if, still prior to them, we should have reflected on their correlative objects, then for the same reason we must first determine about them, i.e. about food and the objects of perception and thought. (415a14-415a22)

[18] Today we prefer to "count" by well-formed propositions with truth values combined under logical connectives leading to formally valid inferences, but without the intrinsic richness of qualitative phenomena. Such a truth functional counting must conform to a countably infinite mathematical coherence to carry validity.

ordered overlapping of the respective semantic domains and their relationships to the phenomena of the science. That argumentative force is inferentially dynamic when coupled with Aristotle's methods of doing empirical science, such as the differentiation of the species of poems according to his system of four causes, the definition of Tragedy, and its analysis into six functional parts. The very polyvocality of each term in relation to the others is what produces the "empirically scientific polysemy" of a coherent argument that maintains access to the phenomenal qualities under scientific questioning (*Post. An. ii*. 1-3) and later stages of scientific practice. As is implicitly recognized in the extensive discussion of the "practical syllogism" (*Ethics vii*. 3.; *De Anima iii*. 11. 434a16-22), we can reasonably construe the first two sentences of the Poetics as presenting a high level "productive syllogism" that connects the phenomena of art works with the capacities of poets in such a way as to open up an exemplary synthesis of plots and poems. The unfolding of the relationships of these productively scientific terms as they function under the idea of genus/species, at work in the method of differentiation according to primary species phenomena as accessible to the poet's creative capacities for imitation, allows the fundamental form of Plot to become architectonic for the production of tragedies as artifactual concrete, composite wholes. Within these two first sentences, we see "threeness" recurring in the *three* pairs of species – Epic poetry *and* Tragedy, as also Comedy *and* Dithyrambic poetry, and most flute-playing *and* lyre-playing – and the "threeness" of the poet's capacities for imitating "in which," "of which," and "in a certain way" that becomes generative when the method of causal differentiation is applied to them and then further developed by different technical practices.

The fascinating thing, as mentioned above in Scene II – Model β, is that such a syllogistically formal and inferentially dynamic "threeness" comes into play when the poet's capacities are made poetically concrete according to the different arrangements of essentially related phenomena determined by the different causal differentiations of poetic materials, forms, and artistic agency in chapters 1, 2 and 3. All of this reasoning sets up the telic turn of laying out the purposive functions of learning and delight as universally causal for humans in chapters 4 and 5. Those functions are what tie together all the prior differentiations into the possibility for producing works of art. They also exemplify one of the ways that Aristotle's system of four causes works to produce specialized scientific knowledge. The *arithmos* of "fourness" constituted by Aristotle's system of causes underlies his different scientific treatises. This system does indeed look like a fundamentally empirical advance over the Pythagorean *tetractys*.

If one wanted to give an Aristotelian version of the *tetractys* as a <u>discursively numerate principle of logical inference</u>, it might run something like this: *one whole* substance to select particular phenomena for a single science; *two* predicative scientific terms in a *single* substantive proposition; *three* pairings of *three* terms in a scientific syllogism; and *four* causes for *differentially* arranging, ranking, and evaluating the disclosed primary phenomena constituting the essence of the substance, that, when combined together in speech, allow for knowing the universal *all* (or "*ten*") of the science of the given substance through extended discursive argument laying out knowledge of the observed phenomena. We can also see how the degradation of Aristotle's scientific logic into routine grammatical reasoning as practiced by later thinkers could lead to a belief in merely verbal "essences," such as the "dormative power" (*virtus dormitiva*) of opium to cause sleep that Molière mocked in his play *The Imaginary Invalid* (1673) at the beginnings of experimental science with its newfound rigors of mechanical causation and self-encapsulated mathematical formalism. Aristotle's science would not have led to an understanding of the chemical reactions and physiological changes of opium – because experimenting on living creatures including people would destroy their natural life-form activities – but his science would nonetheless have a firm grip on the pragmatic facts[19] that taking opium does put one to sleep and deaden pain as well as lead to addiction and loss of rational control over its use (*akrasia*), a decidedly unvirtuous condition. Culturally we have now reached an urgent need for a new macaronic linguistics that mixes the scientific authority of formal symbolic artifacts with the vernacular pragmatic realities of natural language expressions into co-corrective syntheses that combine their differential "arithmetic" powers to gather the qualitative phenomena of direct experience with the formally computed significances of large finite scientific precisions for the purposes of developing human cultural norms for *and* practices of sustainable life-form flourishing.

Aristotle's *logic of scientific discourse* is capacious enough to include teleological reasoning.

Aristotle's productive science not only aims at "the structure of plot" (*muthous*, μῦθος) required for a good (*kalos,* καλῶς) poem, the science also includes the humanizing formulation of the function of a catharsis of pity (*éleos*, ἔλεος) as evoked by incidents of reversals (*peripéteia* ,περιπέτεια), fear (*phóbos*, φόβος) as evoked by incidents of discoveries (*anagnṓrisis*, ἀναγνώρισις), and the catharsis of suffering (*pathos*, πάθος) evoked on the whole of the incidents

[19] "Thus, according to Molière, [the old Scotists] would say that opium put people to sleep because it had a soporific virtue. That was mere verbiage, of course. But to jump from contemning such talk to contemning abstractions was to repeat the very same fault, namely, that of not distinguishing between useful abstractions and useless abstractions. To say that opium has a soporific virtue was a useful expression for some purposes; but it could not supply the place of a physiological theory." Peirce 1983, *The Categories* MS 403, §7.

in the play. All of this is grounded in his insight that:

> Tragedy is essentially an imitation not of persons but of action and life, of happiness and misery. All human happiness or misery takes the form of action; the end for which we live is a certain kind of activity, not a quality. (Ch. 6, 1450a16ff.)

While counterintuitive for us today, such formal associativity with teleological functioning would mean that "premises with scientific terms" can have substantively dual or multiple conceptual domains for saving the phenomena, as these phenomena range between how humans initially have them first in experience *and* how they are experienced when grasped in their primary phenomenal facts. The primary facts are the "base cases" or "instances" captured in speech that enable the discursive laying out of their connective significances. Aristotle's scientific terms are connected throughout the range of phenomena in an extended discourse that explicitly includes the causally universal capacity for imitations with teleological functions (ch.4 – as a telic turn); they are not just univocal terms of strictly propositional scope. Unlike protocol statements in propositional logic, Aristotle's causes allow for a plurality of phenomenal aspects to be grasped in systematic ways *as these aspects* are *present and function in the thing itself* in order that they may be reconstituted through our capacities for expressing their significances in discourse. In this way, the phenomena are taken as "instances of themselves" throughout the scientific procedures and are thereby "saved." If we generalize Aristotle's discursive insight into other systems of causally significant and coincident selections of phenomena, that is, of empirically scientific *arithmoi* of phenomena, we might be better enabled to know phenomena by the robust significances of their tertiary relations of terms.

Turning all the structure of scientific discourse surrounding the six concepts of Theory, Method, Phenomena, Cause, Plot, and Artifact on its head, we can gain additional insight into what Aristotle is doing with them. Each founding concept functions in its own domain of like terms as a category or semantic field of specialized terms that will serve as a wellspring of substantively connected scientific terms that can then be woven together amongst the range of the six categories in developing the whole of the argument. Again, the terms in the categories are polysemic rather than formally univocal.[20] They allow for connections between the categories. For example, the combination of Theory and Method provides organizations for the primary facts of the phenomena – means, object, manner, proper pleasures – as polyvocally determined through the relationship of "genus and species" as theory, and also through the functional roles of each species phenomena as they serve to exhibit differentiations (comparisons and contrasts) as internal relations between the different kinds of causal elements at work in each species when methodically applied among the group of species taken as a whole. Thus the "means" of "speech" are used by epic, dithyramb, comedy, etc. even as this means will have different functions and characteristics in the objects, manners, and pleasures of the several species.

As discussed above, we can find *extended ratios* in the thick micro details of the five chapters of separable causal phenomena: *extended ratios* exist between each kind of causal aspect and among the entire system of different kinds of causal aspects. Aristotle sets this up immediately after sentence 2 as he invokes the "just as" (*hwsper*) connection between color, form, and voice compared and contrasted with "so also" (*oütw*) rhythm, language, and harmony.

[20] I am indicating a polysemy that is coherent within the discursive argument, not the sense in which a single word has many different and not necessarily coherent meanings. This use of polysemy is a more compact mode of expression than permitted by strictly univocal terms.

This employment of discursive ratios is how Aristotle actually exercises the use of scientific terms in his logic of scientific discourse. In practice, he puts the formally productive ambiguities and phenomenal richness of the scientific terms into specifying "ratios" in speech to sort out their respective functions or powers. We see him doing just that throughout his sciences. He is at times explicit about putting two terms together, such as Body/Soul in the extended comparison of how the Soul might have the same relation to Body as the Pilot to the Ship (*De Anima ii.* 1, 413a8–9 and later). He even theorizes about how each sense has a power seated in an organ that has physical magnitude in terms of "ratio" in *De An. ii.* 12, 424b10-30:

> By a 'sense' is meant what has the power of receiving into itself the sensible forms of things without the matter. This must be conceived as a taking place in the way in which a piece of wax takes on the impress of a signet-ring without the iron or gold; …; what alone matters is what *quality* it has, i.e., in what *ratio* its constituents are combined.
>
> By 'an organ of sense' is meant that in which ultimately such a power is seated. The sense and its organ are the same in fact, but their essence is not the same. What perceives is, of course, a spatial magnitude, but we must not admit that either the having the power to perceive or the sense itself is a magnitude; what they are is a certain <u>ratio</u> or power *in* a magnitude.

More immediately apposite to the *Poetics*, Aristotle's discussions of 'voice' (*phone*) in the *De Anima* again make this use of ratio explicit.

> Voice is a kind of sound characteristic of what has soul in it; nothing that is without soul utters voice, it being only by a metaphor that we speak of the voice of the flute or lyre or generally of what (being without soul) possesses the power of producing a succession of notes which differ in length and pitch and timbre. The metaphor is based on the fact that all these differences are found also in voice. (*ii.* 8. 420b5-9)
>
> If voice always implies a concord, and if the voice and the hearing of it are in one sense one and the same, and if concord always implies a ratio (*logos*), hearing as well as what is heard must be a ratio (*logon*). (*iii*. 2. 426a27-b3)

For my argument, the point is that each of the six primary species of "Epic poetry and Tragedy, as also Comedy [and, *kai*] Dithyrambic poetry, and most flute-playing and lyre-playing" contributes to determining an adequate basis of phenomenal comparisons and contrasts to establish sufficient causal factors to differentiate the whole of poetic species in coherently extended ratios.

Each of the pairs of founding terms, Theory *and* Method, Phenomena *and* Cause, <u>and</u> Plot *and* Artifact, sets up a meta-ratio of categories of specialized scientific terms, which are then developed and carried forward through the interweaving continuity of Aristotle's scientific argument. Each of these six beginning points indicates a different sort of supply for scientific terms: 'genus/species' relations structure the differentiation; 'scientific method' provides procedures or techniques for saving the phenomena; 'phenomena' provide the experiences of works of art already being performed in Aristotle's time; 'causes' emerge through deeper insights into the phenomenal origins of our experiences of art; 'Plot' provides the architecture for all the functions of the parts of Tragedy and itself formalizes catharsis into agents acting;[22] and 'Artifact' constitutes the very instances of works of art to be analyzed, explained, and most importantly, adapted to the needs of the city and the audience. All of these beginning points (*archai, Met. v.* 1, 1012b34ff.) and their further scientific de-term-inations are tied together by the collected Greek cultural whole of *mimêsis poiêsis* or imitative makings. Again, Aristotle begins developing exactly that process of extended "ratio-ing" of more specialized terms for the

[22] We can even find an explicit confirmation of the foundational status of 'Plot' as such a high-level beginning point or principle in chapter 6 where Aristotle not only identifies 'Plot' as the soul or first actuality life-form of Tragedy, he also identifies 'Plot' as a principle or *arche* (ἀρχὴ) of Tragedy (**ἀρχὴ** μὲν οὖν καὶ οἷον **ψυχὴ** ὁ <u>μῦθος</u> τῆς τραγῳδίας, 1450a39). Poulheria Kyriakou (1993) links Aristotle's explicit use of *arche* to qualify 'Plot' as a scientific "analogy between μῦθος and the natural substances." I am maintaining that the whole of poetics-itself (*poiêtikês aùtês*) constitutes a 'productive and performative essence' in analogy to natural substances with 'Plot' as the more specialized exemplar for that whole.

materials or "in which" of imitation immediately in the third sentence of the text with the analogical relationship of "just as, …, so also":

> *Just as* (*hwsper*, ὥσπερ) color and form are used as means by some, who (whether by art or constant practice) imitate and portray many things by their aid, and the voice is used by others; *so also* (*oütws*, οὕτως) in the above-mentioned group of [six], the means with them as a whole are rhythm, language, and harmony … (1447a18ff. Bywater; my italics.)

And then continues accordingly for each kind of cause in sequence. This construction of extended ratios of media, characters of action, styles of composition, and relative moral/political evaluations is what is happening at the micro-constitutive level of the text, as the coinciding causes are "stacked up" in a sequence of phenomenal comparisons and contrasts ordered according to their causal origins. (See Appendix A.)

Elaboration of Interpretation Theory for the Purpose of Making the Tertiary Qualities of Scientific Discourse Empirically Available

Now that we are fully "situated" (Dewey 1938, Brown 2012) in the world of the text of the *Poetics* across all the scopes of interpretation from metascientific terms down to micro-specific terms, we can reflectively articulate how Aristotle's discourse has a certain discernable qualitative character in our experience of reading and recovering it: the text presents a thoroughly *reflexive*[23] *grounding of argumentative sequences throughout the entire discourse* by laying down the nexus of productively ambiguous scientific terms within these two foundational sentences (S-1 and S-2). Those polyvocal scientific terms are then developed into argument structures for the entire work as a whole:

> The theory of genus/species relations reflexively self-instantiates through the application of causal differentiation. The theory is expressed through the scientific procedures that structure phenomena according to it.
>
> The scientific method of arguing through connected stages of problem statement and transformation via specialized techniques is reflexively self-instantiating. For example, the causal differentiation to identify the best genres using speech saves the phenomena by

[23] See the next topic for a further treatment of the term 'reflexive.'

presenting them as substantive *contents in themselves* in their various combinatoric arrangements. Thus, in chapter 3, we can notice that Tragedy is more imitatively powerful than narrative because of its dramatic qualities, and in chapter 1, more powerfully expressive than Dithyramb because of its separation of dramatic elements such as melody and diction.

The phenomena are captured initially in their endogenous, freely occurring modes of art as named through the lived interactions of public discourse. Aristotle re-instantiates these modes of art as the same throughout his stages of scientific transformation, i.e., the socially emergent species names of Epic and Tragedy, Comedy and Dithyramb, and Flute and Lyre playing as settling out through an ancient form of "crowd sourcing" are kept and enhanced or idealized within those modes. They are maintained and recur in various argumentative transforms – in causal categories, in quasi-essential definition, and then in analysis of Tragedy into parts, in abducting the architectonic organization of plot, etc. In effect, they *become more of themselves* through the account according to nature.

The primary origins or causes are deeper human phenomena (productive and performative essentials for Poetic Imitations) that are made poetic by the work of the artists and then can function beautifully within the works as artifacts. These causes are common to human nature either as poetic arts or as audience experience and were already active throughout the species development. Clear categorization into varieties of means, objects, manners, and proper pleasures allows a surer grasp for the poet's arts and our appreciations of them that remain true to their primary origins. Such a deeper grip reflexively re-instantiates the more overt phenomena.

The architectonic part of 'Plot' is composed to imitate actions of agents in ways that have the power of an objectified activity of catharsis metapragmatically signified in the performance and artifact, and thereby bring primary causes into a higher order synthesis of the phenomena as plots or "arguments" experienced in productively ambiguous ways for audiences. Higher order synthesis is reflexive because it actually makes the endogenous species into more exemplary instances of their poetic power as experienced by audiences.

'Artifacts' -- "concrete, composite wholes" (*tò súnolon*) materially embody the 'life-form' or soul of the work, i.e., the plot, in a strict integration of the two through art. The "fact" of the "art" is first instanced in the purely human embodiment of performance as in dance, song, and ritual, and only then later on concretized into some sort of materialized symbolic "art" created by poets for experiences of audiences. By taking on more fixed embodiments as persistent works of art, the history of artistic innovation and development is materially self-instantiating as artifacts.[24]

[24] If the reader's own interpretive phenomena referenced here are not evident, it can help to attend to one's sense of reading as not simply a passive taking in, but also as reading that actively evokes our own conversation with what is being said and how the conversation develops. For example, when Aristotle speaks of tragedy, tragic poets, and techniques for presenting tragic events in the *Poetics*, his discourse builds on the instances of each mention of something tragic in ways that consistently return us to reconsidering the tragic from multiple

These functionally different cases of reflexiveness present tertiary qualities of Aristotle's discourse which in the situation of reading the text. We can have these qualities in our experience in relation to our interpreting the text's specialized poetic subject matter with all its reflexive relationships at work in the argument. This reflexiveness is a primary example of accidence (a source of discursive continuity) in scientific argument that Dewey would identify as 'connexitivity': that is "*not so much a coordinate relation as it is a complex of relations*".[25] [26] In the context of modern science, Dewey recapitulates Aristotle's objections to the Pythagorean columns of terms with their unrelated contraries invoked without empirical method and theoretical system despite their mathematical basis (*Metaphysics i.* 986a14-986a22ff.).

Here, in each of the pairs of founding terms when taken together, we have multiple modes of interweaving significances that accrue argumentative force as the discourse unfolds.

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aspects. Upon reading chapters 6 and 13 (14452b30), one might respond in dialog with the text: "Oh, now I see how actions that simultaneously present both a recognition of a fault and a reversal of fate or consequences is more artful and cathartic than two separate plays, one for each, or as separate events in a single play. It's because having both together heightens our experience of the fearful and pitiable as jointly connected in a single instance." When we interact with such enhancing returns to our experience of the tragic, it generates its own specific sense of how Aristotle's discourse has a distinctive way of doing "that", a "way" that feels "very commonsensical," or "tightly developed," or "dull and plodding," or many other qualitative appreciations in a responsive vein. I am pointing out that his sequences of statements all exhibit a characteristic pattern of his stating something and then returning to that statement through further determinations of species-related phenomena that makes the richness and connectedness of the sense of the tragic actually tied to our experience of tragedy as a unified, definable kind. That is, in the reader's experience of interpreting Aristotle's argument, the genre of tragedy becomes an elaborated instance of itself, a 'reflexive self-instantiation' through argued discourse.

[25] See footnote 27. Also Wimsatt's use of 'causal thicket' (2007, pp. 234-244 & 358-59, and Darwin's 'tangled bank,' last paragraph of 6th edition of *The Origin of Species*, cited by Wimsatt p. 12.)

[26] I take Dewey's use of 'connexitivity' as more richly robust than "coordinate relation" to be a modernized recapitulation of Aristotle's move from Pythagorean "coordinated" tables to his system of causal relations as a more scientific "complex of relations" in the phenomenal manifold presented by poetics-itself.

Such relationships of the discursive significances presented in the flow of the text become *re-experienceable* for the active reader inquiring into the text with its characteristic higher order qualities and metapragmatic properties of its discourse. If only Phaedrus had realized reading takes real thinking and arguing, not just mere recitation, he would not have tried to trick Socrates by reciting Lysias' written speech as his own. But that would have meant our loss of the dialogue as the first trenchant account of the effects of the new technology of writing that Plato had mastered. Just as in the situation of art appreciation where the artifact or performance is intersubjectively available for individual experiencing in ways that can be shared and discussed with others without the expectation of reduction to identity, so also can the individual reader's experience have commonalities of pattern and relation in the understanding of the text *without* the expectation that "everyone will agree" in the situation of reconceptualizing and reenacting the argument of the text. Each reader will give a live voicing to the text at hand at whatever level of insight and engagement they can muster from their own experience of it. As Gendlin reports, the interaction of different readings can lead to "heavy smoke" (1972, p. 8.), which then can only be cleared by further discussion in reference to the text and its specialized grasp of its subject matter phenomena, which can at least civilize the conflict in a widening world of the text and its intertextual semantic domain.

In sum, Aristotle's *Poetics* exhibits and formulates the tertiary qualities of Greek poetic works in their own right by means of its empirical science of saving the phenomena of imitation for artistic understanding. Interpretation theory and practice can also determine qualities of the argumentative discourse of the science and present the tertiary qualities of reader-text interactions as access points and guides to the commonalities of a plurality of interpretations.[27]

[27] See McKeon (1966) following Dewey and Collingwood, for an adaptive system of differentiating such discursive tertiary qualities of natural language found in continuously argued texts across different modes of thought. Ian Hacking (2002, 2012) following Foucault and A. C. Crombie has a different way of categorizing modes of "constituting ourselves" in discourse through an open-ended historical categorization of "Styles of Scientific Thinking & Doing."

Such determinate “interpretively situated” qualities provide *affordances* (Gibson 1979, Brown 2012 part 5- Situationism,[28] Dewey 1938) for the reader to interact with while inquiring into the text. The above determinations of a sequence of such reflexive aspects of Aristotle’s scientific discourse disclose how Aristotle’s scientific terms

> “transcend the problem of knowing that particular terms (e.g. ‘good’, ‘pleasure’) are genuinely arbitrary and illustrative of a valid inference. … In my analysis, these ‘term variables’ provide exhibitions (*ekthesis*) of particular instances through natural language as well as inferences under Aristotle’s term logic.” (Lear 1980, p.4)

That is to say, these reflexive aspects “exhibit” or “expose” (*ekthesis*, ἐκθέσις)[29] particular instances[30] of Aristotle’s mode of scientific discourse.

Taking these aspects as results of interpretations made through my heuristic reconceptualizations and procedural reenactments, they provide a metapragmatic context for assessing the “character” of Aristotle’s science as discursive actions. We can *sum them up*, so to speak, through their combinatorics of comparison and contrast into such a judgment of discursive character by recapturing the argumentative significances of discursive accidence, and thereby gain an insight into the “continuum of judgment” (Dewey 1938, ch. XIII) at work in Aristotle’s

[28] “Situations are agent relative and practice relative. … This connects with Dewey’s metaphysical view about interactions: ‘while there is no isolated occurrence in nature, yet interaction and connection are not wholesale and homogeneous. (Brown quoting Dewey).’ Among such “fields of interaction” are the agent-centered situations. … Agents perceive not only the constituents of their situations but the “pervasive qualitative character” of the situation, a qualitative perception (or feeling) of the character of objective transactions between the agent and the environment. The existence of a situation having a certain character is not constituted by the agent’s awareness of it; agents may in fact fail to notice on occasion the sort of situation they are in. Nonetheless, the perception of a certain unifying quality of a situation is in a sense not open to error; the feeling is what it is.” (Brown 2012)

[29] See footnote I-36 above for how I link ‘teleological consummatory acts’ to Mayr’s ‘teleonomic consummatory acts’.

[30] See Liddell and Scott's *Greek-English Lexicon* (LSJ), in specific: “A - II. setting forth, exposition, “τῶν ὅρων” Arist.APr.48a25, 49b6; b. exhibition of a particular instance, ἀποδεῖξαι τῇ ἐκθέσει ib.28b14; “κατὰ τὴν ἔ. ἑκάστου” Id.Metaph.1090a17, cf. 992b10.” URL: http://www.perseus.tufts.edu/hopper/morph?l=ἐκθέσις&la=greek#lexicon. Accessed 3/17/18.

scientific inquiry. Consequently, when these couplings of the six scientific terms are brought together in a coordinated group of productively ambiguous scientific terms, and when interwoven through argumentative discourse, they constitute an empirical science for Aristotle. Rather than Aristotelian empirical science being an obsolete mode of speech, Aristotle's scientific discourse suggests that we still have resources available in natural language to again make use of a logic of scientific discourse open to phenomenal richness provided through the exercise of the human capacities for imitation, imagination, expression, and improvisation. By neoteric developments of natural language across the range of humanly universal capacities we might enable ourselves to productively adapt to the wealth of new experimental knowledge with all its new qualities and affordances that we have established without full telic significances. In order to do so we will have to recognize new levels of accidence across natural and symbolic language use, and consequently develop hybrid syntheses of *arithmoi* of telic significances and the *arithmoi* of qualitative phenomena required for teleological consummatory acts.

The deeply discursive irony of having traveled some hundreds of pages of exposition in order to *recover the meanings* of Aristotle's polyvocal scientific terms in the first two Greek sentences is precisely that for the sake of understanding it is necessary *for human*s to bring the meanings of those terms into the direct experiencing of them in order to grasp their full and wisest import. That is, to restore what would be reduced out of humanly intelligible significance by simplistic reading *also requires many lines of, not symbolic, but natural language argument.* This is what disciplined close reading requires. The irony is that this parallels Ian Mueller's claim about the inevitable length of a machine proof a geometry theorem versus Hilbert's concise natural language proof of it. As you may remember from Scene I:

> Poincare's formalist interpretation of Hilbert, viz. "Thus Hilbert has … tried to put the axioms [of geometry] in such a form that they could be applied by someone who did not understand their meaning because he had never seen a point, a straight line, or a plane" (Mueller, 1981, pp. 5-6, underlines mine) that would allow a mechanical proof.

It appears that both formal and natural language expression require extensive articulation to achieve their significances.

A Dialectical Pair of 'Hybridized Terms' with Essentially Different Technical Vocalities

As an example of contrasting and combining natural language discourse and formal language codifications, the terms 'reflexive' and 'recursive' are closely related but not identical in their technical senses. The purpose of this example is to *productively reambiguate* these two terms both as a related pair taken as a nexus for polyvocal discourse *and* for each term as polysemous in order to instance a hybrid wellspring of significances. Indeed, they have an indeterminate plurality of technical meanings arising out of their different essentialisms – [phenomenal [vs+] mathematical]. In computer science, 'recursive' refers to a certain kind of function or programming procedure which, while recurring back to certain formally fixed 'base cases' in order to complete a calculation, the 'recursion' is nonetheless *constantly proceeding forward* in the calculations. The calculation *must* proceed by first following its algorithmic form and second within the exact formal constraints of Universal Turing Machines. Otherwise the calculation fails and the computer might even crash, a kind of formal-mechanical death. Accordingly, the recursive program never goes back to change the initial specification of the function nor its base cases. For example, the Fibonacci series: 0, 1, 1, 2, 3, 5, 8, 13, … can be recursively calculated from the two base cases of 0 and 1 and the formal rule for generating the next Fibonacci number, ($Fib_{n+1} = Fib_{n-1} + Fib_n$), without any further information beyond the calculations themselves. The calculation of each new number requires returning to the base cases, but never alters them.[31] In this sense, computers are more determinantly "progressive"

[31] The concepts of "reentrant code" and "self-modifying code" do not challenge this assertion. Reentrant code is just a technique that allows for the multiple use of a section of code without loss of program coherence: "Computing: Designating a program or subprogram which may be called many times concurrently, from one or several programs, without altering the results obtained from any one execution;" ("Reentrant Code," *OED*) Similarly, "self-modifying code" is a technique for reducing complexity for the sake of efficiency: "… self-modifying code is code that alters its own instructions while it is executing – usually to reduce the instruction path length and improve performance or simply to reduce otherwise repetitively similar code,

than humans, and may even come to provide cultural scaffolding for humans in their tendencies to fall into various sorts of temporary collapse.

In contrast, for Aristotle, arguing 'reflexively' from the productive ambiguities of the foundational scientific terms, as laid out above, presupposes the possibility of returning to what were our initial perceptions of a thing in experience and revising those lived experiences to better concretize our grasp of the thing-in-itself which was always present in experience, but can now be known in more knowledgeably stable and primary forms. By chapter 6, Aristotle's poetic science intellectually grasps those primary phenomenal facts by abducting higher-order concepts into our experience of them. The higher-order conceptualization of 'Plot' – as the "first essential (*arche*), the life and soul (*psukhē*), so to speak, of Tragedy is the Plot" (6. 1450a39) – serves to elevate plot or story to the function of providing the formal architecture of the play. Accordingly, the productive indeterminacies of 'Plot' in S-1 have been concretized into the formal coherences of Tragedy in chapter 6. The difference from computed recursions amounts to how an argued discourse makes connections *both forward and backward* to the point where our new understandings make it possible to change and adapt our initial experiences through instancing their deeper forms as expressed in our cognition of them through the more and more intelligible focus on their characteristic natures.[32]

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thus simplifying maintenance. Self-modification is an alternative to the method of 'flag setting' and conditional program branching, used primarily to reduce the number of times a condition needs to be tested." ("Self-modifying code," Wikipedia) It is considered dangerous. Nonetheless, programs are quite capable of adjusting their functions based on variations of external input and "learning" to modify outputs from patterns found in data, even when that data is about the program itself.

[32] Dewey (1938, ch. XXI, "Scientific Method: Induction and Deduction") would construe this process as what happens within modern scientific inquiry when we intervene in the problematic situation to change what aspects of the situation are experimentally observed as the hypothesis being tested is used to vary and select more revealing and possibly more predictive features of the correlated phenomena. Of course, such procedures drop notions of a fixed and eternally static nature. However, keep in mind that Aristotle's poetic science does not depend on works of art having that sort of nature: poems could be otherwise. Poems have a productive and performative essence that intrinsically involves the variability of human artifacts.

I suggest that this conceptual development is also a kind of 'return' or 'recurring', but one that is fundamentally dependent on the expressive powers of natural language argument. I call this an instance of 'discursive recurrence,' a manner of "running together" of argument and principle. The key difference between natural language recurrences and computed recurrences is that natural language "adds more than what is deducible or calculable" from the initial term itself as it occurs in S-1. Natural language allows creative abduction into what was said before. It even allows for and may foster 'teleological consummatory acts'. Aristotle was quite clear that poetic science could do so through the catharsis of pity, suffering, and fear. In contrast, 'computed recurrences' demand fully clarified "base cases" and determinate data structures from the start and all the way through. "Outputs" must conform to those univocal constraints for them to be calculated in the first place. What I want to point out is that both of these steps is incorrect: either reducing Aristotle's scientific principles to a mathematically precise notion of 'recursive', or assuming that 'discursive recurrences' must be as precise as computed truth functions to have argumentative force. Similarly, it is incorrect to assert that either of these technical senses can be fully separated from the other, or that we do not need both in order to engage in the cultural work needed at the present time.

'*Discursively recurring'* to 'Reflexive Principles', such as those found in S-1 and S-2, augments their phenomenal grasp in our experience by means of expressing higher-order conceptualizations, such as those that 'Plot' takes on in chapter 6. 'Reflexiveness' as a technical property of Aristotle's discourse at the beginning of the *Poetics* is relatively empty, but it is also productively ambiguous. As beginning points, such reflexive principles allow their reinstantiation in more developed ways that consolidate more aspects of the phenomena within the scope of the particular discourse, so as to increase their phenomenal connectivities while densifying their meaningfulness. Reflexive principles allow us to think more powerfully about our lived experiencing of phenomena. For example, 'Plot' is a substantive but relatively indeterminate concept in S-1; but by chapter 6, 'Plot' is formally tied to 'character' and 'thought', and then further idealized through linking plot to the function of catharsis as constituted and performed by its inner functional parts – reversals and discoveries – as well as the more obvious sufferings. Aristotle's 'reflexive' augmentations are achieved by carrying out the sequence of transformative scientific procedures in continuous inquiry that productively recur to earlier meanings. The three sequential techniques carried out in chapter 6 first capture and then conceptually consolidate the central role of 'Plot': first, the scientific definition of Tragedy elicits for the first time the teleological functions of "arousing pity and fear" and their resolution through "catharsis" (*kátharsis*, κάθαρσις. 6. 1449b28); second, the analysis of the functional parts of Tragedy which explicitly names 'Plot,' and explicates it function as "representing the action (that was done)" as the "combination of the incidents, or things done in the story" (6. 1450a3-5); and third, the idealizing identification of 'Plot' as the central architectonic part of Tragedy that is "the end and purpose of tragedy; and the end is everywhere the chief thing" (6. 1450a23-24), while also elaborating on the inner plot functions of 'Peripeties and Discoveries'. All three of these techniques operate to tie together the argumentative force to what has been, is now being, and what will be said in the treatise. They carry "argumentative force" through additional linkages between scientific terms, and for Aristotle have a discursive logic provided by the rich co-functionings of causally differentiated "middle terms."

Just as identifying an interpretive "discursive recurrence" is one way of speaking that increases expressive connectivity and meaning by means of a 'reflexive' return to "primary facts" in later steps of the argument (as explicated about chapter 6), so also does 'reflexive' have a proper place in mathematics and computing. In order to more firmly establish the intrinsic character of the technical pairing of 'reflexive' and' recursive' as constituting an expressive 'causal thicket', we can see a circle of meaning arise by tracing back from 'reflexiveness' in speech to the 'reflexive' property in mathematics. 'Reflexiveness' has its own technical sense in formal symbol systems as well: "In mathematics, a binary relation R over a set X is *reflexive* if every element of X is R-related to itself. Formally, this may be written $\forall x \in X: \; x R x$ [for all x that are members of the set X, the Relation such that of xRx holds]." The basic example of a reflexive relationship "R" is that of equality: x = x, as in 16 = 16. Other examples are >= (greater than or equal to) and <= (less than or equal to). Mathematically reflexive relations can have additional properties as well when they are combined with other relationships such as 'transitivity' that consolidate additional system characteristics such as the set of rational numbers possessing a 'dense linear order'. For example, if we take R to be >= we have an instance of this definition: "Any binary relation R is said to be 'dense' if, for all R-related x and y, there is a z such that x and z and also z and y are R-related. Formally: $\forall x \; \forall y \; xRy \Rightarrow (\exists z \; xRy \wedge zRy)$. Every reflexive relation is dense." ("Dense Order," Wikipedia) Thus, ">=" is a reflexive relation such that: 4 >= 3, and 3 >=2 as well as 4 >= 2 AND 2 <= 3, 3 <= 4, and 2 <= 4. However, such properties are strictly captured in their formal specifications and require at least countably infinite coherence for 'dense' truth functional consistency. Computed results and artifacts are as fully dependent upon such mathematically 'reflexive' relations as they are on recurrences. Once again, we have two distinguishable technical senses for 'reflexive' that are also constitutive of our hybridized pairing of terms, and equiprimordially entangled in a "complex multi-disciplinary entity." This is not an understanding that could be developed from a strictly propositional approach to extended argumentative discourse.

Using our experiencing of the interpretively generated tertiary qualities of Aristotle's arguments as returns to discursively 'reflexive' foundations or principles, we now have two different technical senses of 'recurrence': one mathematically formal as syntactically self-encapsulated, the other phenomenally formal as lived in our experience. Combining both technical senses of 'recurrence' here retains the wider dimensions of natural linguistic accidence and continuous inquiry, which are not carried by computed 'recurrences' in their limitation to carrying only univocal truth functionality or strictly effective manipulations, even as we gain the large finite precisions unavailable to us without computing as new sources of human significances with their own qualitative presentations in experience. Both of these sources of significance are intrinsically *entangled* in and by our current state of culture and technology. This terminological pairing of 'reflexive' and 'recursive' forms an irreducible dyad of phenomena and forms with an intrinsic plurality of voicings. As a wellspring of significances, the productive pairing provides us with a "complex multi-disciplinary entity," a hybrid principle of expressive capacities.

Such powers of hybrid expression can be further developed with the increased argumentative force arising from *both* technical senses that together can be constitutive of cultural and socio-ecological objects into a more sustainable "causal thicket" (Wimsatt 2007, p. 166, 234[32]). This combination is more *robust* and allows for greater concrete articulation than

[32] Wimsatt is explicit about the "hybrid" character of our embeddedness in nature:

"The biological organism (a developed language using socialized human) has a perspectival structure (actually at its lower levels of biological organization, merging continuously with causal thicket structure we get into the internalized psychological and social realm). Two ontological lineages emerge from this: Those of cultural objects (abstract objects, presumably also viewable as abstract relational properties of objects in the second lineage), and socio-ecological objects (kinds of complex material systems either of them alone. On the side of precisions, computing can help to surface hidden significances as formulable; while on the discursive side, continuous argument can help us to reformulate the deeper human phenomena required for achieving teleologically consummatory acts in our age of combinatorially explosive change and novelty. Again, on the precisions side: even as computed technology can provide cultural scaffolding for humans, such technology will only be genuinely humanizing if and only if we succeed at abducting life-enhancing teleological consummatory acts into the operations of the machines. The old saw of thinking that computers only do what we program them to do has turned out to be a double-edged sword. They will do what we program them to *and more*, and our hold on their impacts can only be achieved if we take all of their induced changes and powers into account not only in our designs for them, but also in our cultural frame setting for our life activities beyond their range of significance.

In broadly cultural terms, our first misconstrual has been to believe that we had such absolute control over the significances generated by computed symbolic agency. As Dewey so astutely observed, new science and new technology will always introduce new qualities and affordances into the collective life-world, thereby changing older received meanings not only through their intrinsic novelty, but also through our own changes and adaptations in response to those novelties. Life-forms close their own circles of significance and existence; they must do so to stay alive and persist.

having the whole range of social, ecological, biological, cultural, and psychological properties). I believe that the connectivity patterns relating these various realms inside and outside the individual are much more complex than represented [in a diagram]. Thus, social institutions obviously are complex hybrids of objects at a variety of levels from both of these lineages." (Wimsatt 2007, p. 234)

A second misunderstanding has been to assume that scientific knowledge itself is necessarily universal and permanent, when in fact scientific knowledge is at best recurrent and culturally malleable over and above its stabilities. Humans no more have absolute control over all the forms of nature than any finite and limited creature of existence does. We have mistaken our radically new understandings of countable infinity as the pathway to a god-like hold on nature, rather than understanding the prolix offspring of infinite conceptualizations as no more than a vast new set of tools and techniques for getting on with the activities of life as has always been the case. How could that go wrong?

Our third misdirection has been to discredit and debase our oldest communicative technology, natural language argument with its highly adaptive powers of meaning creation, even as we return to it again and again for help and reconstructive support in all walks of human life. Many people have encountered this difficulty while "translating" declarative natural language sentences into logical formalisms where the natural language statements are thereby left behind as inexact and subject to non-logical vagueness. This deficient cycle has left us spinning in panicked semantic circles of failures to reestablish sound and humanizing speech through the metapragmatic, abductive, and teleological powers of extended argument, of *logos*.

Fourth, an unintentional failure has been to abandon our own responsibilities for governing the impacts of new science and technology in both common sense and specialized inquiry as mere or temporary subjective externalities. "Words" and "sentences" do matter, and arguments matter a great deal more. Our verbal achievements have greatly assisted our survival activities through their cultural consolidations by again and again allowing us sufficient time and room for surviving as living individuals and communities "for now," and more hopefully, for the foreseeable future – limited as such foresight is. But such success in persisting is highly dependent on our exercising recurrent virtues and reflexively productive teleological judgments about the present life-world mix of thoughts, things, words, and actions as actual realities in our historical times and contexts of life-form communities. Chasing infinity can only get us so far. Inevitably it is the return to a livable finitude under humanizing discourses that will help us keep the indefinitely long chain of times and contexts persisting even as they evolve culturally. One real problematic that our culture currently faces is the confusion of having a great number of hybrid modes of expressive symbolizing that combine computed symbols and natural language utterances in a public space that is itself changing, and that we do not understand well enough to promote a comprehensively sustainable flourishing of life-forms in ecosystems within its finite limitations.

A "Discursively Recursive" Return to the previous visual metaphor of how Aristotle "completes the square" of causation to make additional connections between different "spots" in the text as an instance of the interpretive disclosure of teleological functioning

With regard to the tertiary qualities of Aristotle's text as expressing a thoroughly reflexive mode of discourse, we can now see that poetic science becomes curiously organized "of itself in our experience" of poetic phenomena. We can notice the argumentative relationships of methods and phenomena once again, only more clearly. Beginning again, we note that Aristotle's advances over the *tetractys* break down the whole of poetics into roughly ten species of poetry according to their means of imitation, we can see that the phenomenal grounding of material causes in poetic variation is sufficiently robust in its technical differences to enable the entire sequence of causal differentiations to take hold. When we grasp that that grounding in material causes is adequate *and* sufficient for proceeding to further narrow down poetic excellence according their formal, efficient and teleological differences, we can recover how he is able to clearly identify the three most imitative species or genres of Tragedy, Epic, and Comedy that are suitable for idealizing them to the point of contributing to the civic health and enjoyments of their Greek ways of life.[33]

We can recover and disclose the inner workings of how that method of causal differentiation plays out in Aristotle's arguments by constantly checking with other spots in the text and thoughtfully adjusting to them according to their tertiary relationships of significances. As earlier noted in the visual metaphor for "causal stacking" (Third Interpretive Goal in Scene I), we can now return for a fresh look at how Aristotle arranges his technique into a causal sequence with a cumulative "coincidence of causes" in order to further test the validity of figures 1 and 2. Because of our recoveries of the six basis species, the causal sequence, and the six parts of Tragedy as *arithmoi*, we can open up possibilities for checking other places in the text for coherence and further nuance. When he proceeds through the entire causal sequence, we then have an expanded phenomenal field of differences generated through the "significance power of ten causal overlaps." That causal separation and those overlapping reconstitutions <u>in themselves augment our aesthetic experience</u>, as the long tradition of aesthetic criticism takes for granted as common sense.

One must interact with a work of art and explicate our experience of it in order to fully appreciate its meanings and significances. Doing so, we then *have* the experiencing in a different way: the "one great blooming, buzzing confusion" (James *Principles of Psychology*, 1890, p. 207) of the multiple phenomena in multiple species with which we are initially presented is now

[33] Hence the multiple attempts to reconstruct the "lost book" on comedy including those of Umberto Eco's *The Name of the Rose* (1980), Elder Olson's *The Theory of Comedy* (1968), and Walter Watson's *The Lost Second Book of Aristotle's "Poetics"* (2012).

selectable in a system of four different categories of phenomena and multiple different but ordered groupings. Moreover, this system allows the incipient teleological functioning taking place within the tenfold overlapping causal nexus to become a *self-organizing activity* for that whole of poetics as we experience it. Aristotle's beginning with the group of six species, which appears to be organized through a "coincidence power of six" as a formally associated whole of poetic phenomena, is sufficient to ground a synthetic noticing of the primary causal differences in experience. That power of noticing differences when coupled with the technique of differentiation for the material, formal, and efficient causes builds the potential for an even more intrinsically teleological differentiation around the three best species, Comedy, Epic, and Tragedy.[34] In effect recovering those causal cross-functioning interactions through active interpretation allows us to *multiply them through*, so to speak, to obtain our own isomorphic experience of such working together.

With this understanding of how Aristotle's reflexive mode of discourse organizes our own aesthetic experience, we can test our earlier pair of models of Aristotle's traversal of four causal frames starting with an "additive causal stacking" and moving to a "multiplicative functional completion." In relation to the significances brought together by our recovery of the tertiary quality of reflexivity of Aristotle's discourse, do these models still capture all the salient details of how this traversal of four causal frames effects a completing organization of poetics as a teleologically ordered functional whole? In Scene I, the "completion of the square" of causal

[34] It is the inherent methodological flexibility of this arrangement, as it might be organized according to different poetic phenomena and different humanizing purposes, that the Chicago Critics first took note of in the 1940's and '50s, in their attempt to reground aesthetic criticism.

functions was depicted before by these two figures starting with “causal stacking” and moving to “functional completion” from Fig. IV-6 to Fig. IV-10 and following:

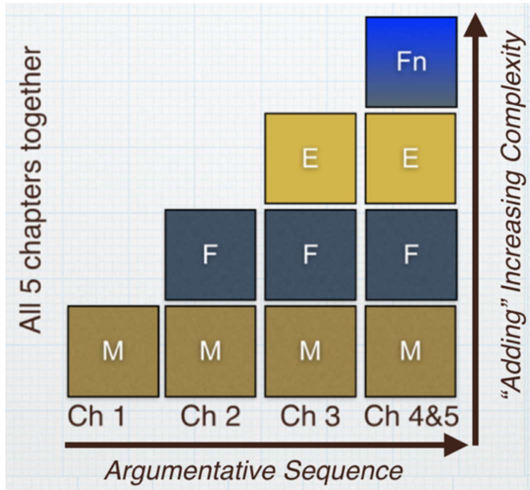

Fig. IV-6 Cumulative Four Causal Sequence (II-2 repeated)

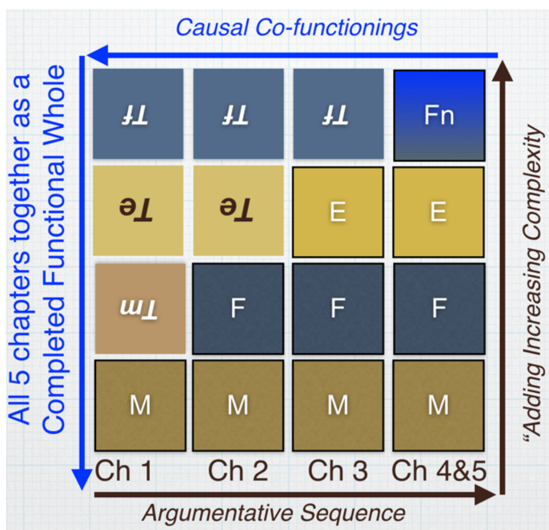

Fig. IV-7 Completed Four Causal Combinatoric (II-3 repeated)
(Now considered as a hasty assignment of “**T**” functions)

Viewed now in the context of the tertiary qualities of Aristotle’s text as a thoroughly reflexive mode of discourse, we can reassess this model (Figures II-2 and II-3) as somewhat hastily taking the completion of the causal square consisting of the teleological functions of these aspects of the material, efficient, and formal causes:

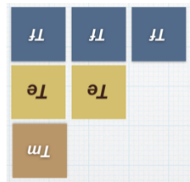

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Fig. IV-8 Breakout of Teleological Functions as first conceived

My earlier interpretation (Scene 1) comes up wanting in the light of my suggestion that we take Aristotle's '*arithmos* of six" (as applied in his analysis of Tragedy into six parts) as a way of discursively symbolizing the <u>functioning of a group of phenomena</u> as a *formally associated system of functional parts with a specialized purpose*. That is, we can understand Aristotle's '*arithmos* of six" as a way of systematically capturing the both the <u>additive stacking of coincidences</u> (comparisons and contrasts) among the species and the <u>multiplicative organizing activity of functional interactions</u> across all the species for a determinate group of phenomena in *logos*, which is then open to recovery in our experience through a rigorous interpretive process. It would be the recovery of the background of the causally systematic scientific organizing activity for all of poetics that we then experience through the particulars in the performance of an actual work of art of a certain kind such *Oedipus Rex* as a tragic play with its plotted synthesis of a catharsis of suffering, pity, and fear.

Checking the initial interpretation of the completion of the causal functions (Scene I) against Aristotle's use of an '*arithmos* of six' after the definition of Tragedy (6. 1449b32), we find him stating the system of *six parts for Tragedy along with their causal origins*. Double-checking with the causal origins, we find that Aristotle this time explicitly states that three parts (plot, character, and thought) arise from formal causation, two from material causation (melody and diction), and one from efficient causation (dramatic spectacle). This observation is a clear positive confirmation of our schematic hypothesis of “six cofunctioning causes”, (3 [+|*] 2 [+|*] 1),[35] organizing the parts of a tragedy. But we also find additional nuance. This second check discloses differences with what I presented in Figure I. In that figure, I *slipped into an abstract regularity not warranted for this specific case* of the *arithmos* of six as adapted for use in determining the parts of Tragedy. I mistakenly matched Teleological contributions as “added” up into columns by Aristotle’s sequence of causal differentiations by merely verbal alignments into “multiplicative” or cross-functional rows of causation: Tm with Formal, Te with Efficient, and with Tf with Final as given in this figure:

Fig. IV-9 Breakout of first version of the Completed Combinatoric

without thought of different possible functional arrangements according to the “crossing” or contrasting, or “aligning” or similar functional relationships between the parts of tragedy.

Because Aristotle explicitly develops the six parts of Tragedy directly from the definitionally stabilized multiplex of phenomena, he captures more of their interactive relationships: the formalized multiplex of phenomena give access to a more particularized reconfiguration where material causation contributes more significantly than efficient causation,

[35] “6” is a ‘perfect number’, a positive integer that is equal to both the sum of its proper divisors including itself. With the notation “[+|*],” I am denoting that both 3 + 2 + 1 = 6 *and* 3 * 2 * 1 = 6, thereby indicating the *combinatoric power* of addition and multiplication that Aristotle found in the *arithmos* of six.

since the material differentia were more technical in Aristotle's view, while formal causation is still dominant. Aristotle derives the parts of "plot, character, and thought" from formal causation, melody and diction from material, and spectacle from efficient causation. This derivation suggests that: we pair Final causes with these three parts in the top row of Final causation as evidence of formal primacy in teleological functioning; then the pairing of Final causes with two material parts placed in the Efficient row as evidence of material technicality co-functioning with artistic stylistics; and the one part arising from the efficient causes in the Formal row as evidence of how Spectacle arises out of the dramatic form of the play. Here is a figure that better matches the explicit causal linkages that Aristotle gives for the parts of Tragedy in chapter 6 with Tm and Te swapped.

Earlier Arrangement Revised Arrangement

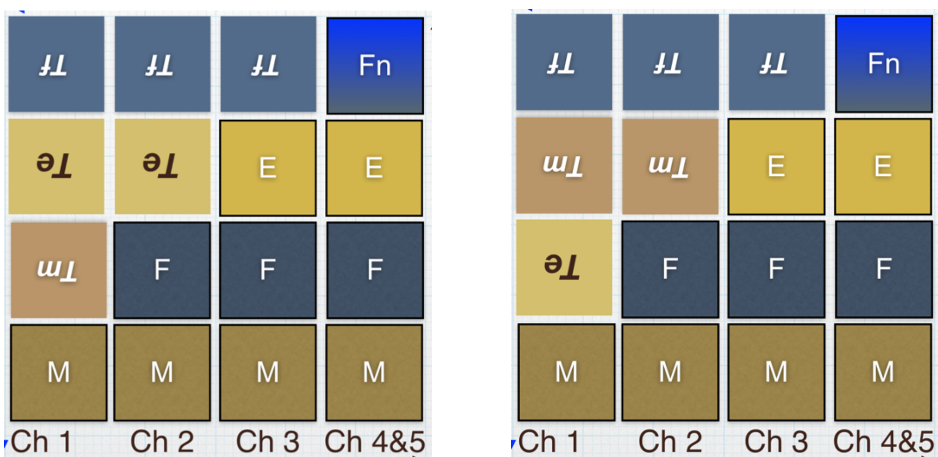

Fig. IV-10 Comparison of original and refined through clue from the parts of tragedy combinatoric

As noted, Aristotle's discourse is ever nuanced in its details through its capture of a continuum of judgment. He is constantly thinking out further phenomenal variations for what they might reveal about their substantive essence and its proper activity in the nature of the substance. In Figure IV-8 (left) my abstractly simplistic diagram was in a too static arrangement, and not quite varied enough in its pairings to keep up with Aristotle's differential sensitivities to the specific phenomena of Tragedy as a species. Figure IV-8 (right) presents the revision of the earlier figure in light of chapter 6's links of causation to specific parts. Following Aristotle's text, we can note that the teleological functioning of material causation, Tm, now shows a horizontal contrast next to E,

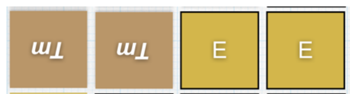

Fig. IV-11 Refined matching of material function with efficient cause

as a functional "crossing" of Tm and E instead of the apparent similarity of Te and E in figure IV-8 (left), while efficient causation is contrasted with Formal in the second row from the bottom

Fig. IV-12 Refined matching of efficient function with formal causation

and retains the prior formal as contrasted with Final in the top row.

Fig. IV-13 Refined matching of formal functioning with Final causation

For what it is worth, we now have a more coherent mode of association across the rows, with each pairing showing a contrast instead of figure IV-8(left) mixture of similar and contrasting.[36]

[36] Combinatorically then, the second actuality of the causal functioning of "reading across" the additive whole of the causal system can now also be seen as a "reading down" of the interactive significances of the causal combinations in the columns. Reading in this way, we can speculate that Aristotle may have anticipated, or at least left open, the possibilities of a further elaboration of modes of narration and dramatization as we have seen them develop historically. Wayne Booth recently explores this functional multiplex of material, efficient, and formal aspects in his concept of the character of the "implied author" in his *Rhetoric of Fiction*, *The Company We Keep* and elsewhere, which are also ethical or teleologically ordered treatises. As a reader, I try to develop an open mindedness about such obscurities. Do these causal functions emerge more concretely later on in the text? Over historical time with artistic innovations? Or do they indicate a further theoretical step that Aristotle declined to follow through on? Are they simply not significant enough to merit articulation? Or do other more content-specific formulations of poetics just take over beyond what the causal coincidences are not able to

The payoff of this rearrangement is that it better brings out the emergence of a functional "ranking" of parts as implicit in the analysis of the species into parts. Aristotle confirms this understanding with his ranking of parts and his deprecation of "Spectacle," which in performance is not even necessary for appreciating the "tragic effect" of the drama of the play. As we read at the end of chapter 6 (1450a38-50b20):

> The Spectacle, though an attraction, is the least artistic of all the parts, and has least to do with the art of poetry. The tragic effect is quite possible without a public performance and actors; and besides, the getting-up of the Spectacle is more a matter for the costumier than the poet.

That is, this example of the "additive" co-functionings of cause, part, and tragic function allows us to see final causation as "multiplicatively" cross-functioning into the productive and performative essence of Tragedy.

The satisfying or completing aspect of this confirmation of teleological functioning turns out to be a two-way consistency, rather than a single line of discursive coherence. By turning back from the end of chapter 6, where Aristotle explicitly puts different values on the different causal forces or mimetic contributions of the six parts, we can "reciprocally confirm" that Aristotle explicitly does evaluate the six parts according to their causal origins. This fact adds a teleological completion by ordering the contributions of the causes as laid out in the first three chapters. Each of those chapters orders its specific kind of causal factors into degrees as well. What is being ordered (kind of cause) and the sequences of ranking vary according to cause, but

adequately theorize and express, as Aristotle actually notes at 1449a7: "If it be asked whether Tragedy is now all that it need be in its formative elements, to consider that, and decide it theoretically and in relation to the theaters, is a matter for another inquiry." Or are they just beyond Aristotle's scientific articulation given the limited range of art available for his time and culture?

the exposition of each cause is ordered to increasing mimetic power or capacity from low to high. (See Appendix A for the orderings of each cause.) The ranking according to cause at the end of chapter 6 *also* ranks the functional force of those three causes into 3 degrees. This can be seen in the six completions of the teleological co-functions represented in the visual model:

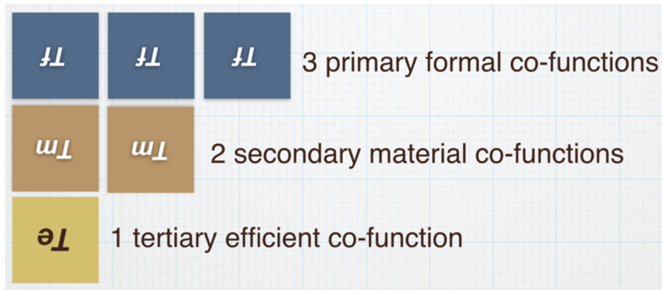

Fig. IV-14 Breakout of the Refined Teleological Co-Functions

This reciprocal confirmation gives additional warrant to the already worked-out recovery of different degrees of mimetic functioning, discovered in the straightforward ordering of specific causes in each causal category (depicted in Appendix A). To top off such completion with yet another threesome, we can now take in how chapters 4 and 5 also present a teleological evaluation or ranking simply by reducing the species or genres of art down to only Tragedy, Epic, and Comedy and treating them in that order. Of course, this reciprocal connection and co-determination consists of a multiplicity of ordering schemes depending on the technical features of each, so there is not a clear arithmetic reduction to "3" in each case. That sort of mathematically abstract mapping is not the kind of clarity Aristotle is seeking. His aim is to make the tertiary qualities of artistic creations more mimetic and enjoyable. Nonetheless, there are implicit connections present and at work in the scientific discourse. These connections add to the discursive expressiveness of the argument.

This new interpretation brings four different interpretive "spots" in the text – each under a different scientific technique: causal differentiation (stage 2), analysis of the parts of Tragedy (stage 4b), the reformulation of Tragedy in terms of 'Plot' (stage 4c), and narrowing the manifold of species down to three primary and most imitative ones (stage 3) – into greater consistency. As usual, Aristotle's method aims to let the empirical character and function of phenomena take precedence over any formally reductive heuristic or simplistic redundancy. The suggested interpretation of a "coincidence power of six"[37] as a purposive system of an interactive phenomenal grouping now better matches the obvious functional character made explicit in his arguments about plot at the end of chapter 6, with its further intricacy of its own functional parts of reversals and discoveries. In effect, the "completion of the square" of causal factors transforms their intersections into a matrix of experientially stabilizing comparisons and contrasts as a way of saving the complex of phenomena at this higher order of functioning. As we have seen, doing that helps to make sense of multiple features of the argument as well. Accordingly, I claim the interpretation "checks out" with multiple "spots" (Gendlin 1962. See footnote IV-41 for quote.) in the text and at least gives plausible sense to the type of significance that this second instance of an *arithmos* of six has as a statement of a particular functional system with a different specialized purpose from that of the group of six species. Of course, because the phenomena presented are only "stable in discourse," this line of interpretation could evolve upon further insight or from a different interpretive approach. The argumentative coherence disclosed, that of finding a schema in Aristotle and experiencing that he is doing some kind of logical work,

[37] Even today, we have the mythos of a conjunction of "six degrees of separation" as constituting all the coincidental relationships that are needed to connect any two people in the world (Frigyes Karinthy. "Chain-Links," 1929). See also Dunbar 2008 and the apparently six levels of dramatic intentionality he finds in Shakespeare's *Othello*.

and yet not being quite able to lay out the specifics in a fully deductive way, is both a common experience for a reader and a source of fruitfully recurrent puzzlement. Without doubt, however, it is also at times a source of genuine irritation when the argument just does <u>not</u> "lie flat." Nonetheless, the disciplined practice of interpretive "model and test" interactions with the text will have clarified the argument and drawn out syntactic, semantic, and pragmatic "connexitivity." (See footnote I-9, p. 49.) Moreover, in general, powers of writing and reading might well improve if we can succeed in developing expressions built on a hybrid mix of more formal scientific components and natural language argument.

That which is not, is

Again, as we saw earlier in Scene I, a false model has led to a truer theory (Wimsatt 2007) of the text, i.e., one that captures a bit more of the argumentative significances across different spots in the text. We can find another precursor of mistaken theory leading to better understanding in Socrates' theoretical claim that his only knowledge was that of knowing what he did not know. Socrates' Dialectic art was sufficient to turn Theaetetus' soul (*periagōgē*, *Rep.* 518D) from mathematical precision back towards a fully embodied perceptual flourishing and the virtue of being less harsh on his friends. That "turning back" was to a truer human nature already possible for Theaetetus but not yet brought to flourishing or fully functioning in his presentations to the world. That is, through Socrates' maieutics, Theaetetus finds a way to unify "perception" with "knowledge-as-mathematics" through the "power of the tongue" provided by *logos* (*Theaetetus* 185C). Even for Socrates, practicing that philosophic art of speech in dialog with Theaetetus did not yet appear to be knowledge to Socrates, since he understood himself as "only knowing what he does not know" in a more abstract sense. Socrates himself still needed an Eleatic Stranger with a positive philosophic method to learn that "that which is not, *is.*" Namely, that human mistakes are real and can lead towards deeper understanding, so that Socrates' only knowing what he does not know was not ignorance, but itself a form of actual knowledge of himself as human and the son of a midwife, Phaenarete, with his own maieutic practice of one who "brings excellence or virtue to light" through philosophic dialog (Benardete 1984, 1993).

The value of all this is not so much to prove a certain thesis about the origins of Aristotle's science, as to be able to note clearly what changed in Aristotle's approach to knowing the nature of things. Aristotle's innovation of separating out a system of causal factors in thought, but not in the being, of the things put a new constraint on what was considered knowledge, namely that knowledge needed to save the empirically evident phenomena of the things. And Aristotle's shift in the "measures" of knowing from mathematical principles suggestive of order but not actually finding those orders in nature, to finding contentful contraries as measures that provided public access to each of the kinds of causal factors that were chosen because they directly expressed the phenomenal aspects to exhibit their "natural" orders. Aristotle established discourse *as* empirically scientific and therefore closer to actual phenomena.

Of course, all the thought behind the founding of poetic science that I am claiming to be there in the first two Greek sentences may seem to simply be too much to find in the text, especially given the overlapping difficulties of parsing them into productively ambiguous terms as given above. It might also appear that I think it is not possible to criticize Aristotle's *Poetics*. That of course is not true. Even if the text remains meaningful to us about art, that does not assure it is complete for all times and all modes of art, or even adaptable to them all. A further excursus into Kant's theory of the sublime could make it clear that Aristotle did not capture a fundamentally important side to art objects and experiences with regard to our aesthetic experiences of infinity.

If for the sake of argument, we accept that the *Poetics* has a mode of scientific foundation akin to, say, Euclid's axiom system for geometry, a similarly idealized account for Euclid's system would have to accept that there was a fundamental gap in the fifth postulate about parallel lines; yet we do not reject Euclid's achievements because of that gap. We moderns have also rejected that Euclid's geometry is the true description of space in an absolute way without rejecting its continuing usefulness and elegance. Again, on the poetic side of Socrates' two paths for the return of poetry to the city, poetic or through argument, it would certainly be possible to claim that Shakespeare developed tragedy and comedy to a higher quality beyond that of the Greek model, thereby making the claim for the poetic return. *Hamlet* is a genuinely modern play with its structured self-reflections and its deep play within a play to "catch the conscience of a King." Nor does Aristotle anticipate the use of the mad comedy of Lear on the heath in order to heighten Lear's tragic downfall.

Overall, the point is that without a fully idealized recovery of what might possibly be coherent and valuable in Aristotle's scientific discourse, we cannot proceed as fully with a genuine critique of it. There are many reasons for wanting a full plurality of aesthetic and critical theories and seeking whatever excellences they might successfully articulate. Kant even finds such a plurality necessary in judgments of taste.[38] Nonetheless, we need a firm foundation to rise to the level of assessing Aristotle's or anyone's discursive achievements before we toss away

[38] "It seems, then, that we must not regard a judgment of taste as *egoistic;* rather, we must regard it necessarily as *pluralistic* by its inner nature, i.e., on account of itself rather than the examples that others give of their taste; we must acknowledge it to be a judgment that is entitled to claim that everyone else ought also to agree with it." (*COJ*, *Ak.* 278; Pluhar trans., p. 140.)

things we did not actually understand. For neoteric inquiry, this standard is both grounded in the strengths of a tradition, while still not dogmatically encapsulated within it so as to prevent an open-minded engagement with the actual phenomena of today.

Two Warrants for this Interpretive Method

So, while that apparent excess of my textual idealization might indeed be the case in various particulars, I also provide two strong warrants (Toulmin 2003) in support of the findings I claim. First and most important, it is highly plausible that Aristotle was capable of doing the work of rising up from the phenomena to the first principles of a science behind the scenes and then explicitly articulating them without further ado. After all, he was working out how to do that in his other scientific treatises all along. Moreover, this claim that S-1 and S-2 are rigorously foundational is especially likely when we remember he explicitly theorized this philosophic use of a specialized dialectic method for doing so:

> It [dialectic] has a further use in relation to the principles used in the several sciences. For it is impossible to discuss them at all from the principles proper to the particular science in hand, seeing that the principles are primitive in relation to everything else: it is through reputable opinions about them that these have to be discussed, and this task belongs properly, or most appropriately, to dialectic; for dialectic is a process of criticism wherein lies the path to the principles of all inquiries. (*Top. i.* 2. 101a30-b4.)[39]

Such implicit work is precisely what the *productive ambiguity* of first principles or axioms requires and provides through its expressive powers of discursive coincidence. Indeed, the constraint and necessity of resolving such productive ambiguities captured under an *arithmos*

[39] One could argue that Aristotle's laying down the scientific principles I am asserting constitutes a practical exercise of a "*strong* dialectic" in service of grounding a productive science, rather than establishing metaphysics – an exercise that goes beyond Plato's and other's "reputable opinions" to establish a causal and empirical science of imitative making (Irwin 1988, p. 482ff. Italics mine.).

drive the extended argument of a specialized poetic (or other) science and provide the conceptual coherence and procedural continuity which give rise to the expressive integrity of a great book. Scientific practice constantly turns to the possibilities for 'emergent precision' as a source for posing interventions and conceptual frames to then be empirically tested.

The interpretive fact is that chapters 1-6 present a fully developed 'scientific dialectic' aimed at developing the ground for Aristotle's resolutions of the problems of the "synthesis of noble/good plots" by leading to a scientific definition of Tragedy and the analytic determination of the functional parts of Tragedy. This procedure is quite different from his other mode of 'disciplinary dialectic' wherein he assembles the views of prior thinkers to help establish the proper beginnings for a given science. A good example of disciplinary dialectic can be found in book I of the *De Anima*.

The second strong warrant for these findings is provided by interpretive method. The key heuristic tool for interpretation that I have developed for achieving sufficient rigor to disclose and procedurally resolve such productive ambiguities is a *schema of discursive 'scopes of interpretation'* or *'levels of meaningful associative integration'*. This schema of scopes or levels determines the varied semantic, syntactic, and pragmatic connections as taken at all the levels between syllables, words, phrases, sentences, sections and extended arguments (Jackendoff 2002), which are made concrete in argumentative discourse. In the process of 'heuristic reconceptualization' and 'procedural reenactment', the emerging interpretation is guided by and checked against this range of interpretive levels adapted to the predominate contribution of a section of text of a given scope, even as each also carries all the threads of argument to some degree. For this heuristic tool, here is the schema:

Table IV-1 Schema of Scopes of Interpretation: [Meta | Macro | Meso | Micro]

where each level or 'scope' integrates a field of significance within a larger, complex whole of argumentative discourse:

Meta: the conceptual field surrounding the text such as the mutual relations of Poetics to Life Science (*De Anima*) with shared and different understandings of "Life-Form" or Soul in productive [vs.+] theoretical sciences.

Macro: expresses the primary theme and purpose of the argument in the text, for example: Laying down the productive science of Imitation-itself and synthesizing Good/Noble Plots in sentence 1.

Meso: the local discursive work of the argument as it develops by procedurally differentiating Poetic Species by means of a systematic causal structure one causal context at a time chapter by chapter.

Micro: the details of each step as it develops from one to the next, each one after and before another in "continuous" argumentative sequence, with each step completing the previous, making its own point, and then unfolding into a consequent point. For instance, Aristotle notes how Dithyramb and Nome mix all their media elements together, whereas Tragedy and Comedy keep them separate, thereby establishing an essential material difference between the two otherwise similar pairs at one particular spot in the text.[40]

Searching for significances at all these textual scopes with their manifold overlaps and functional interpenetrations, and then making them explicit in "trial interpretations" builds a world of implicative sense and higher order meaningful connections sufficiently robust to capture the full range of textual modes of significance as a whole for the text in question in all their discursive continuity. This process can be stated as a conceptual and procedural whole:

> *When taken together as a schema of interpretive discipline, each of the different scopes of textual selection becomes an 'interpretive operation' that can be applied to the problems of understanding the author's structures of ideas and methods of argument through heuristic reconceptualization and procedural reenactment, as the reader progressively adapts them to the unique complex of discursive qualities across the full range of*

[40] An example of what this schema means in practical specifics will be made explicit and concrete in the exegetical process. This overview presents the interpretive results of that practice.

conditioning circumstances from individual and disciplinary to cultural and historical that are encoded in a primary text.

Performing that process allows the discovery and disclosure of the tertiary qualities of the argumentative connections encoded in the text as a 'lived datum' for the reader.[41] The concrete specifics of the resultant integrative interpretation can then be productively stated in terms of the text itself through the coincidence of the heuristic reconceptualization and procedural reenactment with the original text. With practice, the use of such a schema becomes an epistemic virtue. While this interpretive method is certainly open to question and improvement, any serious objections would have to take into account its systematicity.

Aristotle's 'Productive Ambiguity' as Recovered from An Argumentative Discourse and its Tradition of Interpretation that began with Aristotle's Interpretations of Plato

The opening two sentences do most of their work in the *interface* between the levels of meta and macro as Aristotle's theory of science is applied to and made concrete in the *transition*

[41] This interpretive tool is a systematized generalization of Eugene Gendlin's practical insights into serious reading by 'focusing' on specific "spots" in the text that are then recurrently taken on the whole, which for the above interpretive tool means active interpretation at all four scopes of careful reading:

> "An interpretation rests not on its own plausibility, but on checking back against the work being interpreted – only if the interpretation of a given spot also illuminates other places, can it stand. To be correct, an interpretation has to check itself out beyond question, has to reconcile and suddenly clarify many places previously puzzling."
>
> …
>
> "Not only will a correct interpretation clarify many places and resolve other puzzles, but it will turn out, once you have arrived at the correct interpretation, that the philosopher quite literally and explicitly said it himself. Now that you have at last formulated the right interpretation you can suddenly see that, in these sentences right here, that is exactly what he said. Until you worked your way to having this understanding, these sentences went past you unclearly. Therefore, you didn't see them as saying this until after you yourself thought your way to it." ("Two Ways of Reading a Philosophy – And Their Pitfalls," pp. 2 & 3. Emphasis Gendlin's. URL: http://www.focusing.org/gendlin/docs/gol_2038.html). Richards (1992) might call such "spots" "narrites," and has his own insights into textual complexity in scientific narrative.

from the field of metascientific significance to the field of significance for a particular subject matter,

[Meta | Macro |.|.|].[42] Aristotle adapts his metascientific vocabulary to the purpose of founding a specialized poetic science with a scope that comprehends the *Poetics* as a whole. As the relations established by these two sentences are further elaborated, they provide deep grounding for all the work of the poetics as a whole. Not only is that prospective work set up for development, Aristotle also brings it all back into the very statements of S-1 and S-2 by their densely or continuously literal determinations of the foundational scientific terms that I have indicated by means of the tags for six scientific starting points: Theory and Method, Central "Essence" (Plot) and Kind of Thing (*tò súnolon*), Phenomena and Cause. Being 'densely' or 'continuously literal' is another way of saying *productively ambiguous* for argumentative natural language discourse. For the ways in which each of these starting points is "self-instancing" through their densely packed conceptual and procedural generativities, as carried forward into the continuously developing argument, are precisely the ways in which more than one thing is said by each phenomenally scientific term without contradiction or incoherence.

As I have explicated, the tertiary quality of reflexive self-instantiation for the six starting points of the science constitutes a productively ambiguous principle for the discourse as a whole that we can identify in our experience of reading. This qualitative exhibition only becomes determinate as the discursive structurings of each beginning point are interwoven in their specialized cross-determinations. In these senses then, Aristotle's first two sentences taken

[42] Here by "[Meta | Macro |.|.|]," I'm using my typical notation for contraries or schemes, e.g., [noble | average | base], to emphasize that the reading focus is *primarily on* the conceptual and argumentative continuities at the Meta and Macro levels, while the other two, Meso and Micro, are left implicit.

together as an integrated pair form a complex group of 3 pairs of terms that together are sufficient to ground poetic science as a whole and aim it towards the synthesis of good/beautiful poems. The beginning two sentences form a highly articulate *productively ambiguous* and *teleologically complete dyad* rather than an incomplete and indeterminate one. Again, we have a kinship to the precisions of a mathematical axiom system, but one regulated by empirical phenomena rather than deductive reasoning.

Any book that exceeds the expressive capacity of truth functional relationships alone (MacIntyre 1981, p. 83 – quoting Quine 1960) provides an extended and ordered discourse that may rise to a genuinely distinctive level of 'continuous significance'. The best texts, such as most Aristotelian treatises, register significances on all the levels, often in very different modes of argument (McKeon 1998 (1966); Hacking 2002). To be sure, the opening two sentences of the *Poetics* are cryptic and obscure, but only for the benefit of ease of reading for its non-philosophic audience of poets and critics who would not care about such scientific subtleties, while nonetheless remaining uncompromising in their rigor for productive science through their very literal terseness.

Unraveling the productive ambiguity of these starting points a bit more, we can see that the concept of concrete, composite whole ('*tò súnolon*') in S-2 does further structuring work beyond founding the idea of a poetic or made thing in conjunction with the developing method (*methódou*) of poetic science in S-1. The co-generativity of both of these terse sentences is developed through a multiply applied concept of a *relational network of significant and interpreted wholes* present in the developing method of poetic science (Innis 2009, pp. 9ff.). This co-generativity is made *concrete through the specialized scientific terms of an empirical science,* which articulate a particular sort of phenomenal subject matter with an artificial "body" appropriate for the analogous life-form or plot. This structuring provides us with a concept of a holistic discourse development that is instantiated through the sequential discriminations of the *content* of the science, and as an organizing *discursive sequence* for the exposition of the science as a whole. The multiple "wholes" – such as 1) poetics as a genus, 2) all of the species severally taken together, 3) each species itself, 4) Tragedy as the most important species, 5) its six functional parts, 6) tragic plot as soul and equivalent to the species, and 7) the three parts of plot with their inner functional system of the parts of catharsis with its affective parts of reversals, suffering, and discoveries within the essential forms of character, action, and thought again constitutive of the plot as a whole function – *all* fall under the concept of '*tò súnolon*' by "coinciding holistically" in a characteristic way for Aristotle's modes of argument. *Each* '*tò súnolon*' *instance can stand for the whole of poetics-itself as a different* <u>*phenomenal structure*</u> *in the appropriate scientific context*, a kind of extended scientific metonymy if you like, which I am identifying as a case of 'discursive *arithmoi* of phenomena'.

Indeed, "*poiêtikês aủtês*" under the *arithmos* of systematic causal differentiation <u>stands for itself in a technically combinatoric way</u> as an instance of "phenomenal comprehension" not entirely dissimilar from power set comprehension, particularly in the context of how the set of all the combinations of the numbers in the set {1, 2, 3, 4} does. Note the similar "comprehending" notion for the set of all subsets indicated by the large bold curly braces: **{**{1}, {2}, {3}, {4}, {1, 2}, {1, 3}, {1, 4}, {2, 3}, {2, 4}, {3, 4}, {1, 2, 3}, {1, 2, 4}, {1, 3, 4}, {2, 3, 4}, {1, 2, 3, 4}**}**. Making this connection to the symbolism for the formal system of set theory might invite concerns about possible paradoxes about encompassing wholes. The simple fact is they dissolve into the realities of poetics-itself (Dewey 1938, pp. 363-364). For the positively productive science of the quasi-substance[43] of poetics-itself, there is no need to think of a set of all poems that are not instances of poems being a member of itself, for any such poems simply fail to be good poems, or even poems at all.[44] The field of poetic significances has its own standards of excellence wherein human artifice, i.e., the powers of human works of art, find their achievements in bringing the world of poetic possibilities into concrete, composite wholes of experience that have the capacity to place us back into our own particular human conditions with new insights and deepening integrations. Each such successful work provides a "model of experiencing" that determines the possible field of aesthetic experience as situated in present conditions, but open to the historical and theoretical possibilities of the full range of human life-forms. The long tradition of reading and interacting with the *Poetics* with its recurrent power to influence and aid artists and critics alike is also a strong indication that Aristotle's scientific treatise is also <u>not</u> a member of the set of discourses that are not productively poetic.

Much more interesting than such possible paradoxes is the possibility for new genres or made-species to emerge. At first such innovative works would *appear* to fail to be works of art precisely because our traditions and conventions for assessing artistic excellence would not be able to properly judge them. In fact, our silos of expertise actually set us up for this problem, as

[43] Ultimately, the fact that even for Aristotle, works of art are not "naturally fixed substances" becomes an advantage. The *Poetics* with its theory of artifacts as concrete, composite wholes is actually quite close to most of nature for us as we have learned how to change and manipulate *phusis* from quarks to living things to our entire technologized world. Aristotle is indeed more modern than we think.

[44] There is the interesting edge case, however, of a successfully realized work of art that expresses this conundrum in some artifactual fashion thereby becoming a genuine work of art. Dada could fit here. Of course the formal analog would be to a Gödel sentence that is true but not derivable from within the formal language. Likewise, non-art or anti-art art has had some followers at least since Dada, and quite possibly throughout human history from prehistoric cave art to the present.

Kuhn noted back in *Structure* about scientific cultures of research. In our time, even the pursuit of knowledge requires that potential knowers be required to adapt and integrate themselves into an expertise that is within a bounded disciplinary domain. Art criticism is not exempt from this constraint, whereas the actual production of art is. Emergent art forms and new genres would fail to be recognized until those traditions and conventions of critical knowing catch up to the performative and potentially humanizing powers of the new works. Those new powers are among the very developments in human life-form expressions that are most promising and most dangerous for existing culture. Only when we have opened our experiencing to the point where their apparent failure to be knowable becomes a basis for our own growth and reintegration will their appearances become re-cognizable as works of good or bad poetry, or really not poetic at all.

The intense irony of these formal facts, that both Plato and Aristotle would have appreciated, is that computer programs with their powers to influence physical nature, living things, and humans by means of a <u>fully formal symbolic agency</u> indicates that some programs become or are integrated into new genres of art and thereby enter into the discourse of poetics-itself. That is, the only way we figure out how to do that is in and through new modes of experiencing and discoursing about them. We have no choice but to turn to the improvisatory variety and possible leadership of artists and their works to capture their insights. Aristotle and his measures of opposition, or contraries, can be of assistance here. One might even say that this set of contraries still has relevance to us once we assimilate computational symbolic agency as a new player on the stage into "those acting":

> "Since imitators imitate those acting, and since it is necessary for them to be either of stature (*spoudaios*) or inferior (*phaulos*) (characters are pretty nearly always consequences of these alone, for everyone differs in point of character by vice (*kakía*) or

> by virtue (*ἀretê*)), they imitate either those better than what is on our level or worse or even the sort that are on our level, just as painters do." (*Poet*. 2. 1448a1-5, Benardete/Davis trans.)

For our newly created "Hamlet" situation as a program that generates a play within a play, the very crux is not that programs can generate new tragedies autonomously thereby usurping human agency, but rather it *is* that at root, programs imitate and simulate human agency, and perhaps occasionally exceed it in alien or possibly god-like ways.[45]

The undeniable fact that programs often imitate us at degrees beyond our small finite human capacities to calculate, yet within the bounds of their large finite formalisms, poses our thoroughly post-modern crisis; and thereby challenges us to make them subject to poetic capture by including them within our quiver of poetic causes. Assimilating this power to artistic creations thereby concretizes possibilities into performing a more extensive cultural capture, including requisite moral and political adaptations. Rather than programs murdering our cultural parentage, as many are very worried about and is the nexus of a great deal of current creativity and debate, we need to collectively seek "The Soul of a New Machine" (Kidder, 1981) as a new pretender in the courts of human responsibility and judgment. This inquiry will require bringing the 'formally' or 'discretely literal' products of computing within the wider scope of the 'continuously literal' expressive powers of extended natural language discourse. That conjunction might even amount to the integration of the stability and integrity of the countably infinite resolutions of strictly finite and halting programs within our full range of human

[45] There is also a comedic side to this multiplication of Hamlets as Aristotle-in-translation does say: "… thus assuming that comedians got the name not from their *comoe* or revels, but from their strolling from Hamlet to Hamlet (*kata kômas*), lack of appreciation keeping them out of the city." (*Poet.* 3. 1448a37-38. Bywater trans. Capitalization mine.)

expressive powers. As Aristotle knew well, being "finite" (J. Lear 1988) is a fundamentally *telic* property of human existence even with all its time-enframed excellences. For humans to flourish they must adapt to and extend their circumstances to ensure sustainability within a life span. To a large extent, these new questions and inquiries are constitutive of the work and domains of a Digital Humanities – inclusive of Humanizing the Digital – with its peculiar attachment to countable infinity, as this new discipline emerges among all the others.

Here, then, we can see something of the power of extended discourse to capture the qualitative robustness of phenomena as they are grasped with productively ambiguous pairs of terms in two sentences. And by tracking a second aspect of Aristotelian argument, we can treat the opening two sentences as performing the foundational work required to capture the entire science as a structured expositional whole by means of their noetic merger of theory *and* phenomena, according to a methodical development of causal relations and their consequences. For Aristotle's argument, this noetic merger is required in order to determine a scientific substance at the beginning of the scientific discourse in a principled manner. This second aspect is a tri-fold instantiation of the coincidences of the concept of a concrete, composite whole – i.e., 1) poetic theory, 2) poetic phenomena, and 3) poetic object (made artifact). For us, this noetic merger provides a basis for exploring and determining a fourth emergent coincidence – that of consolidating 4) poetic functions of catharsis for our age and context. This mode of articulating coincidences points to a discursive impetus for the synthesizing the rest of the neoteric discourse, viz. computationally embedded poetic science.

When looking at this productively ambiguous, but nonetheless discursively complete determination of the dyad of these two sentences as a foundational step, we find an extended argument development for the *Poetics* through Aristotle's logic of scientific discourse. We have an exemplification of the concept of "concrete, composite whole" as instantiated by a complete basis set for foundation. This basis has its own internal structure. The necessary theoretical concepts required for a specialized science of poetics-itself as a whole are given in S-1. The grounding observations of actual species and primary causes are given in S-2. The whole is again instanced in a different manner in the combined unity of S-1 and S-2 through their merger of theory *and* phenomena, which is required to determine a scientific substance as the principle of the discourse. While finally, the unification of Plot in S-1and Artifact in S-2 gives the science the subject matter it needs to develop. To see all this in the text requires the recognition that there are indeed multiple mutually coherent interpretations of the same words at work in one and the same grounding expressions. Aristotle is signifying a plurality of references in a singular pair of utterances without loss of scientific consequence. Quite the contrary, he is actually generating the particular productive *epistēmē*[46] that makes the science possible and drives its development.

Bringing all this reconceptualization and reenactment back to the exegetical unfolding of Aristotle's text, we need to keep in mind that the overarching goal here is not to determine and codify doctrines, but rather to track the development of Aristotle's scientific concepts and modes of argument as deep ways of thinking expressed in natural language discourse that may provide us with insights for neoteric inquiry. The reason for this methodological orientation is simply that we have a greater need to know *how* Aristotle advanced discourse into an empirically and

[46] *NE vi.4,* 1139b30-39. "…; it is therefore by induction that [starting-points, ἀρχῆς] are acquired. Scientific knowledge (ἐπιστήμη) is, then a state of capacity to demonstrate (ἕξις ἀποδεικτική), and has the other limiting characteristics which we specify in the *Analytics*; for it is when a man believes in a certain way and the starting-points are known to him that he has scientific knowledge, since if they are not better known to him than the conclusion, he will have his knowledge only incidentally." (Ross trans.)

phenomenally centered science, than to maintain a faith in a specific doctrine as fixed in significance across times, places, and cultures.

The heuristic reconceptualization presented above allows us to gain insight into how knowledge is constituted through the course of argumentatively applied scientific techniques. By the time the reader's reenactments of significances in the text get to 'Plot' in chapter 6, all of the six scientific terms presented in S-1 and S-2 will be at work together, each one adding conceptual determinacy from its own constituting source of significances to the concept of plot and its activity in the experience of poets, audience, and philosophers. That is, these six scientific terms will increasingly "coincide" and develop coherent significances in their formation of the concept of plot as a phenomenal function in Tragedy itself and in individual works of tragic art. Indeed, we see rhythms or patterns of comparison and contrast that appear as linguistic rearrangements under the different causal selectivities as they are brought to bear; these rearrangements enable us to grasp the different species as they are distinguished within the whole of poetics-itself. (See Appendix A.) Aristotle's periodic reformulations of the functionings of relevant poetic wholes and their relative parts into groups of six also work to deepen our conceptual grasp, as each aspect from genus to species to particular plot variants is interwoven in the argument. All of these combinatoric reformulations from cause to cause amount to a knowledge of making across the range of aesthetic experience: from the artist's increased understanding of the possibilities of her chosen species; the audience's enhanced experience of the tragic catharsis; the critic's greater ability to compare and contrast given works of art; and to the philosopher's ability to shape and enhance the community in which works of art are created, enjoyed, and criticized.

The overall interpretive approach I took to exegeting Aristotle's *Poetics* was to start with simple or literally straightforward initial interpretive heuristics such as "Sentence one expresses a 'table of contents' for the treatise." Such simplistic beginnings then undergo a process of exegetical correction and deeper articulation as a scientific narrative (Richards, 1992), that increasingly matches the full conceptual depth of the pluripotent text until a more robust, and hopefully adequate, reconceptualizing model for what actually takes place in the scientific argument emerges (Wimsatt 2007, Chs. 2 and 6). In point of discursive fact, S-1 lays out the concepts of poetic genus and species, a complex list of problems to be treated in the science as a whole, and a coincident indication of the proper scientific methods for inquiring into and resolving those problems. This emergent interpretive argument produces an entextualized model[47] that exceeds the literal expressiveness of such a beginning interpretive heuristic without denying it a continuing everyday applicability.

At the core of the above described exegesis, which flows primarily from the sequence of scientific tasks outlined in Greek sentence one (see pages early in Scene I), is Aristotle's coincident argument about the phenomena of poetic species laid out in Greek sentence two. S-2 again has three moments. The first moment is the determination of the full range of possible species phenomena as a group of six emblematic art forms arranged in three pairs that constitute as a complete functional whole of poetics: Epic poetry *and* Tragedy, Comedy *and* Dithyrambic poetry, and most flute-playing *and* lyre-playing. Aristotle's strategy here is to pull together a

[47] That is, the processes of producing interpretations in terms of argumentative performance, i.e., the employment of meta-communicative framing devices to signal that the current discourse, is a performance of an entextualized "extended discourse." (Paraphrase from John A. Lucy, 1993, p. 21.)

system of species-based comparisons and contrasts already manifest in the poetic activities taking place in the city as the substantive ground for causal differentiation. This grouping constitutes an overt phenomenal account of the primary facts. The second moment is the positing of an essential *bauplan* or genus structure common to each poetic species, viz. they are each "concrete, composite wholes" (*tò súnolon*), and reflexively, the entire group of six is also a concrete, composite whole of poetics-itself. The third moment in S-2 is the identification of the "primary facts" ("in which," "of which," and "in what way") that are then further elaborated in the more finely observed account of the phenomenal specifics following S-2. Both the "primary facts" of S-2 and the detailed accounts are at work together in imitative making and also as the source of noticeable differences between the species: a) "imitations in different things" (aka "means"), b) "of different things" (aka "objects), and c) "differently" (aka "manners").[48] Again we can see that S1 and S2 constitute the theory and phenomena of poetic science required for the specialized treatment leading up to the proper formalized synthesis of good and beautiful tragic plots.

There are many additional theoretical and phenomenological concepts implicit in these two sentences that must be drawn out in order to understand Aristotle's *Poetics* as a *productive science*, i.e., one that deals with the production of effects through arts of imitative making. Key to these additional concepts are the notions of poetic form and function that are used to develop a *"productively" essential* definition of the best and most imitative species, Tragedy. In very brief terms, here is my take on what a 'poetic essence' consists of. Because poems are artificial

[48] This identification of "primary facts" makes use first of the Benardete/Davis translation of the Greek for these facts as prepositional, and secondly Bywater's translation of them as phrases with modern terms.

(*technê*) rather than by nature (*phusis*) alone (cf. *Physics xx, Met. VII.4-6*), they do not have an "essence" (*tò ti ēn einai, Met*. 1032b1ff.) strictly identical to that of a physical or biological thing. This fact is often captured by shifting talk from "species" in nature to talk of "genres" in art. I claim that poetic objects, of sufficient development as to have a working plot of a definite genre, have an *essence of poetic artifice:* a 'productive and performative essence.' I argue that it is the poet's synthesis via arts of imitative making (*mimêsis poíêsis*) that potentially *achieves the defined character* of a tragedy, as formulated by Aristotle, through the poet's practices and improvisations. This positing of a "productive essence" is contrary to the view that an artifact cannot have an essence at all.[49, 50] While not strictly by nature since poems can be otherwise, nonetheless poems have functionally definable forms, and we are dealing with an Aristotelian productive science that finds "forms" for species *on explicit analogy with living things having their species' life-forms or souls*.[51] Thus a "genre" concretizes an essence through realizing a

[49] An issue also raised by Mayr, as I have noted above.

[50] There is also a significant body of scholarship now questioning whether even Aristotle's biology conforms to our strict modern concept of "essence." See David Balme, "Aristotle's biology was not essentialist," 1987; also, Lennox 2001, Pellegrin 1987, Wilkins 2009, ch. 1.

[51] It is clear that Aristotle makes reciprocal analogies in both directions between biology and poetics that interrelate the two different specialized sciences without contradictions, or vicious circularity, at a meta-scientific level. Not only does he state that the plot works under analogy to soul, he is clear that "making" is constitutive to intellective soul at *De Anima iii*-5, 430a10ff., where he says:

> "Since *just as* (*hwsper*) in the whole of nature there is something which … is potentially all the things, while on the other hand there is something else which is their cause and productive (*poietikon*) by producing (*poiei*) them all, *these being related as an art to its material – so the soul* will also be characterized by these differences.
>
> And there is an intellect (*nous*) which is of this kind by becoming all things, and there is another which is so by producing (*poiein*) all things, as a kind of disposition (*hexis*) like light does, for in a way light too makes (*poiei*) colors which are potential into acting colors (*energeia Xrwmata*). And this intellect is separate (*hwristos*), unaffected (*apathes*), and unmixed (*amiges*), *being in essence activity* (*te ousia wn energeia*)."

fully functioning particular poem of a definite kind as an individual work of art *of a certain sort* with the performative parts proper to that genre. While there is no essence of an individual such as Socrates, Socrates nonetheless has an essence as a human being. There also would be no essence of Socrates *as human* without Socrates as an individual. The existence of classifiable individuals is the basic property required of any substance (*ousia*) for there to be a science of that kind of thing.

As limned in S-2 of the *Poetics*, and parallel to Socrates' essence as an individual human that exercises his knowledge of dialectics with his interlocutors, the productive activity (*enérgeia*) of the poets – poets make poems in the city – establishes the phenomenal existence of the subject matter of "poetics itself" (*poiêtikês aὐtês*) as dealing with natural groupings of classifiable individual artifacts when they pulled together according to their functionally different "species-themselves" (*eἰdôn aὐtês*). The productive activity of the poets establishes these species as a substantive basis for doing a philosophic science of such productions, as either impermanent or persistent artifacts of a certain formal character. By a poet's achieving a genre form recognizable within the city, the poem has all things in it required for being a "thing of that kind" in its cultural context. Such a 'productive and performative essence' is both "of the city" and "in the city," and thereby both a technical achievement and a completing social activity of greater or lesser value, as noted by Plato. Such works are a kind of artificial thing, poems, that are also in need of an intelligible poetic science that works to formally structure poems to the good of the city and its citizens, as Plato required for the technically based return of poetry (*Rep.*

(Quoted from Eugene T. Gendlin, 1994. "Ultimacy in Aristotle: In Essence Activity." Italics mine.)

X, 607d-5[52]).[53] However, this poetic science must be a phenomenally empirical science that is equally led by what the artists themselves do and produce and by the actual cathartic effects induced, not a strictly theoretical one.

In my interpretation, then, Aristotle's *Poetics* is a productive scientific response to Plato's call for a further technical treatment of poetry that would find a way to bring it back into the city, which satisfies one of the two possible avenues determined by Socrates. The *Poetics* does so by idealizing a proper synthesis (following chapter 6) in such a way as to discursively assist the composition of good and beautiful works of poetry. Moreover, since imitation (*mimêsis*) is natural to humans and our first way of learning (chapter 4), poetry is at root a natural expression of human Being with a proper function according to different modes of catharsis; these modes are appropriate for the completion of that culturally conditioned form of human nature in individual teleological consummatory acts, and in the adjustments to the city wherein they exist. The follow-on inquiry into a range of model structures akin to Aristotle's system of around 16 species variants may then provide some rough beginnings for finding a modern "generic basis" for productive and performative species determinations, ones that are appropriate to our times and conditions as inclusive of the telic commonplaces of prior historical and conceptual human achievements.

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[52] *Republic x.* 607d-5: "And surely we would also give its protectors, those who aren't poets but lovers of poetry, occasion to speak an argument without meter on its behalf, showing that it's not only pleasant but also beneficial to regimes and human life. And we shall listen benevolently. For surely we shall gain if it should turn out to be not only pleasant but also beneficial."

"We would," he said, "undeniably gain." (Bloom trans.)

[53] See also Kant, *COJ* §73 Ak. 394, for a related approach to a thing's purposiveness with regard to living things having a natural purposiveness and the difficulties of defining a "natural purpose" without invoking teleological judgments which are intrinsic to and arise out of the concept of art. Aristotle anticipates this in a different way at *Physics ii.* 2.

Generalizing from the situated interpretive process with its continuities of tertiary qualities to current problematic situations

We might now have acquired a bit of leverage for seeing ways to improve our understandings of our currently confused experiences of the new scientifically and technologically produced qualitative aspects now present in our daily lives. We gain leverage on these new qualities by turning to their presentations of tertiary qualitative aspects shown by the presentation of things and our experiences of them. Just as argumentative discourses can present tertiary qualities through our interaction with them as cultural artifacts, so also scientific and technological achievements, which are certainly cultural artifacts as well, also present tertiary qualities through our interactions with them. Such qualities are not merely or simply "given": they are and can be interactively engaged with as an ongoing felt datum that, under life sustaining conditions, can be reflected on to guide us in 'situating' our problematic encounters with these tertiary qualities in order to alter them through productive inquiry.

Such new modes of productive inquiry would have to consist of a plurality of culturally sensitive *and* scientific ways of discoursing that scaffold the intentional production of intersubjective experiences through extended natural language argument. Based on what I have shown in Aristotle's discourse and its relationship to the modern mode of numeracy, such intentionally generated experiences can now include hybrids of natural language discourse and formal symbol system expressions within the modes of productive inquiry. Such hybrids allow fresh combinations of formal symbolic systems with mechanically effective symbolic agency *and* the more telicly robust expressions of natural language discourse by taking both as cultural agents in their own right. These hybrids would synthesize cultural '*arithmoi* of phenomena' [vs.+] modern scientific '*numbers* of significance,' where the latter are mathematized scientific results: as noted, I have termed these combinations '*arithmoi* of hybrid significances'. But how might we gain even the slightest of insights into how the posited hybrid operator of "[vs.+]" might in fact provide a way of bridging between these two linguistic modes: i.e., the polyvocal resolutions of Aristotle's empirical saving of the phenomena [vs.+] the univocal precisions of formal and computation numeracies that capture conceptual regularities' underlying phenomena?

Without any claims to resolving this problematic in a fully articulated way, I think I can at least point to a potentially *shared realm of significances* wherein polyvocal and univocal might find commonalities of function in their generation of mixed significances. For dealing with the crossover between these two approaches to tertiary qualities of experience, Dewey provides some insights into what the verbal character of the concept of "kinds" actually signifies. In his realization that different bundles of qualities can have the same "functional force," we might find a way to bridge between the unification of qualities provided by an '*arithmoi* of phenomena' and the functional activity of 'numbers of significance'. It might be possible that a given '*arithmos* of significances' could receive a plurality of satisfactions for a scientifically grounded determination of "kinds of objects or events." (See full quote below.) Dewey identifies such a possible *interface* revolving around a very different way of understanding the technical term of "kind": this identification resorts to the process of inquiry as <u>instituting "kinds"</u> as determinations of qualitative assemblages that are fixed only in conjunction with the emergent logic of a particularly situated inquiry, rather than a "kind" being an idealized conceptual essence independent from and above actual experience.

As discussed earlier with regard to combinatoric structure and representational expressiveness of the four models (models α, β, γ, and δ in Scene II), an "interface" is something that can vary dramatically in its "power of representation" (Norman 1993). For example, Donald

Norman clarifies how there might be different representations of the same underlying task structure such as the different experience of "play" for the "game of 15"[54] (Simon 1996, pp, 131; Norman p.53) versus the game of Tic-Tac-Toe; these two games actually have the same underlying formal structure and yet provide overtly different experiences, one frustrating and "no real fun at all," the other rather neat and satisfying if kind of simple. A well designed humanistically sensitive interface can make all the difference with regard to the human accessibility and interactive success with difficult scientific and technological achievements. We can see this in high relief in the differences between a terminal interface for running programs and a graphical user interface: it was the latter that made computing available to "the rest of us." Such interfaces must be designed for human accessibility and designed to foster humanizing purposes.

Given such varieties of mediating presentations as not only open to design but actually requiring it for accessibility, we can consolidate the need for further trenchant questioning of the possibility of such hybrid discourse. Dewey points to how such a possibility can arise in scientific inquiry:

> "Immediate qualities in their immediacy are, …, unique, <u>non-recurrent</u>. But in spite of their existential uniqueness, they are capable *in the continuum of inquiry*, of becoming distinguishing characteristics which mark off (circumscribe) and identify a *kind* of objects or events. <u>As far as qualities are identical in their functional force, as a means of identification and demarcation of kinds, objects are of the same kind no matter how unlike their immediate qualities.</u> Scientific kinds are determined, …, with extreme disregard of immediate sensible qualities. The latter are irrelevant and often obstructive in the institution of extensive systems of inference and hence are not employed to describe kinds. (Dewey 1938, p. 250. Dewey's italics, my underlines.)

[54] Adapting Simon, Donald Norman states the game as: "Let's play a game: the game of "15." The "pieces" for the game are the nine digits – 1, 2, 3, 4, 5, 6, 7, 8, 9. Each player takes a digit in turn. Once a digit is taken, it cannot be used by the other player. The first player to get three digits that sum to 15 wins." This combinatorics structure is isomorphic to the game of Tic-Tac-Toe.

We have to develop and accept a culture that favors such interfacing between "value-free" science and teleological common sense by recognizing the fact that there exists a plurality of possible transformations between the 'numbers of significance' of science and the '*arithmoi* of phenomena' of experience. Even as our culture has rushed, even raced, headlong into a digital age and an increasingly complex biological matrix, we still have a long way to go in making our ecologically sustainable habitus a digital humanity. And yet the possibilities do exist and artists are already working furiously to gain insights into its new modes of experiencing.

In this digital age, computers do not embody infinity; they only produce a physically concrete way of approaching it more closely than we as "limited beings" can – through their access to, their interface with, very large yet still finite computations. Aristotle already intuited such possibilities in his delineation of the infinite as divided by the "actual infinite" and the "potential infinite" (Lear 1979-80, 1988) in ways that allowed for humans to not simply stop somewhere along the number line, but to actually find ways of flourishing through a teleological resolution of the never-ending race of Tortoise with Achilles into an enriched, well-centered, compassionate, and finite exercise of the life-forms. We have to make teloi for ourselves together with others as situated in our physical, biological, social, political, and cultural environments including those powerful niche disrupters of science and technology, which we have developed to stimulate ourselves into evolutionary adaptations – if they don't kill us before we can adapt. In Aristotle's understanding, the phenomena that we study in social science, cultural studies, and characters of personality, as well as human biological capacities, are all within the scope of human nature: keeping this understanding of humanity as natural in mind centers us in culture. Moreover, his range of treatises shows that he was quite aware of the intrinsic variabilities of human experience as requiring different methodologies than those of pure mathematics and strictly theoretic sciences. His studies of different political constitutions, ranges of ethical differences, and artistic improvisations dialectically and rhetorically adapt to the different subject matters to "save their particular phenomena" through different specialized methods according to whether they were practical or productive sciences.

In Aristotle's own reactions to the excesses of Platonic "forms" with their mathematical regularities imposed on an intrinsically more varied human experience of nature, Aristotle's philosophy found the means within natural language discourse for both organizing and saving the phenomenal integrities of political and ethical practices as well as poetic productions. To "save the phenomena," Aristotle invented a term logic which takes advantage of polysemy and the tertiary relations of phenomena as powers of expression for developing the more than strictly formal associations of deduction made possible by the accidences of natural language. From a modern logical point of view, Aristotle's use of a logic of natural language discourse seems almost ridiculous, but we ultimately have to take into account the very strange fact that the inventor of logic with its syntactically clear syllogistic figures of reasoning almost never wrote his sciences in explicit syllogisms. Yet his scientific terms and arguments remain productively intriguing to us today in their surprisingly fruitful phenomenal concreteness that gives us ways of turning to developing "scientifically advanced common sense," ways that are wise, prudent, and aesthetically satisfying in their phenomenal richness. We are certainly fortunate that Aristotle was willing to take such risks not just for the sake of a technical saving of poetry for the city, but also for the sake of advancing discourse into an empirically scientific form of expression. Nonetheless, we face new problems with entangled manifolds of new qualities and higher-order phenomenal relationships that will require the expressive powers of both natural and artificial languages for their integrative solution and exposition.[55]

In order to approach our present problems, one methodological principle we must carry forward from Aristotle's science is that extended discourse, *logos*, is crucial to lay out '*arithmoi* of hybrid significances' as constituted through argument, in order to capture the intrinsically teleological meanings and behaviors of the full range of life-forms including our own. This teleologically grounding aspect of rational discourse is not as strange and uncommon as it may seem today.[56] In fact, as Dewey would recognize, it is as humanly universal as is "common sense." For example, we still intuitively recur to using *arithmoi* whenever our mode of speech takes as primary the meaning or phenomenal behaviors of a grouping rather than their number or mathematical relations, as in "The Gang of Six," "The Seven Liberal Arts," "The Seven Deadly Sins," "The Ten Commandments," "The Thirty-Three U.S. Constitutional Amendments," etc. Again, in less overtly institutionalized but very prevalent ways, we often make enumerative lists of points or topics in our thoughtful discourses that exceed the expressive character of "power

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[55] Richard Buchanan (Buchanan 1992) initiates a poetics of design for helping us come to grips with the entanglements of "wicked problems," through his construction of a pluralistic system of "placements" in natural language that can be taken on by designers in their practices of invention and adaptation.

[56] A nuanced and conceptually dense contemporary case of a successful problem resolution using *arithmoi* of phenomena, that of the educational disunity of the knowledge disciplines expressed in a vocabulary of morality, can be found in McKeon's "Character and the Arts and Disciplines," 2005, pp. 283-298. In this article, McKeon progressively determines and differentiates a reflexive system of four liberal arts into one of liberal disciplines and their antithetical tyrannies, when the initial field of significance across diverse characters, arts, and disciplines would seem intractably incoherent. He finds accidences and other natural language sources of discursive continuity to allow for transformations of the diverse plurality of ways of knowing into a general framework for purposive education. Unfortunately, the article does not engage with scientific phenomena as such, relying more on the full use of the expressive powers of natural language. The article and an interpretive schema for this can be found at: https://www.dropbox.com/s/6v3nzvlxpajnnmd/McKeonCADSternerExegChartsComb.pdf?dl=0

points" on slides without expecting a mathematical justification for the enumeration, even though there may well be an underlying phenomenal or functional organization with purposes at work that is numerate. As with everyday converse and common sense as well, these commonplace ways of speaking are not typically organized into a scientific account because their already functioning telic significances would be "subjective" and are therefore not "objective." We would not even think to do that.

Yet combining common sense and science (Dewey 1938, ch. IV) lies within our current reach for the hybrid phenomena of a scientific *and* cultural re-grounding and reinvention. As our scientific knowledge and technological prowess combinatorically explode, it becomes ever more urgent for us to transform it from the siloed constraints of expertise and institutional technologies into culturally advancing common sense. This transformation is the primary goal and purpose of neoteric inquiry as an activity of cultural adjustment. In my view, the key to a fruitful synthesis of science and common sense lies in placing our efforts into recovering the phenomenal particularities of *concretely situated circumstances* with their *telic significances intact* (ibid.), rather than seeking <u>only</u> universal physical/mechanical laws and formally encapsulated theories <u>separate</u> from and <u>legislatively commanding and controlling over</u> local differences and varieties of commitments.

Moreover, we need to culture ourselves as well as bacteria and other life-forms, even as we seek ways in which to ecologically balance ourselves with those other life-forms which are always, already doing that for themselves and reciprocally to us through evolution. As we are gradually coming to realize, we have already become more and more able to introduce chaos into natural processes. For acculturating ourselves, hybrids of these two modes of expression, advanced common sense and scientific knowing, hold the most promise. Through them, we might be able to establish new modes of *aiming to interact and abide* across groups and levels of society with their institutions and freedoms, from within our concretely situated circumstances, powers, and their finite limitations constituted by “piecewise approximations to reality” (Wimsatt 2007).

While overtly idealistic, such an intent, when feasible, could help to restructure experience in productively ambiguous ways that open up possibilities for growth and adaptation into new ways of flourishing. New modes of aiming to interact and abide across individuals, groups and levels of society might emerge from different disciplines in relation to advanced common sense. From cognitive science, for example, Robin Dunbar’s research suggests two beginning points for hybrids of scientific knowing and advanced common sense: on the one hand, Dunbar determines a *schematism of the human capacity* for around six levels of dramatic interaction, and on the other hand, “Dunbar’s Number” states the finding that roughly 150 people sets a “cognitive limit to the number of people with whom one can maintain stable, meaningful, and mature social relationships” (Dunbar 2008). Such cognitive powers and limits could well be applied to the design of social media apps, and many other human situations. From philosophy and science, another example can be found in C. S. Peirce’s work, which might also scaffold an arena of inquiry along hybrid lines, since Peirce recognized our abilities to verbally formulate metalinguistic signs and their modes of performative signification (Parmentier 1994, pp. 1-44).[57]

[57] As Richard Parmentier remarks:

“For Peirce, semiotic relations are anchored in the linkage between signs as constituents of cognitions and external reality, the character of the world ‘whatever you or I or any man or men may think of them to be’ (MS 2.96:18). This linkage is not a static relationship, since human knowledge and belief about reality must be acquired through inferential processes in which signs and their objects come into truthful relation: ‘The whole effort in investigation is to make our beliefs represent the realities’ (MS 379). Reasoning involves coming to believe true representations of reality. It is semiotically

Understanding such “linkages between signs” could also be turned to enabling better cultural interactions. But these are only a few out of an indefinitely large, but finite number of examples.

Anticipating a new synthesis of poetics and science, of making and knowing

Returning to our starting distinction between scientific terms of mathematically essential forms and those of phenomenally essential coherences, it should be clearer how these two modes of expression, wherein the regularities of nature, life, and culture are concretized in different ways, can be productively intertwined. From this viewpoint, we can now place the overall project between the expressiveness of *univocal* scientific terms of <u>discrete formal symbolisms</u> and the expressiveness of *polyvocal* scientific terms of <u>continuously literal discourses</u>. By doing so, I contend that we are in a better position to face the challenges of explicitly developing hybrid expressions constituted by poetically *and* intelligibly traversing or “running to and fro” between them. Not only is there space for the creations of algorithmic agency, there is also a need for creating new *arithmoi* of hybrid significances including already culturally embedded phenomena *and* those new phenomena produced via symbolic agencies of digital technology, as well as other mathematized scientific expressions, that capture and concretize the range and contents of manifest appearances in the same context as their interface with non-mathematical qualities of experience. We need new systems of contraries which empirically *and* mathematically bind together in hybrid discourses that concretize both phenomena and scientific significances that could have the needed expressive power to re-connect our currently fragmented worlds of experiencing.

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mediated in that all thought takes place through the medium of signs and it is realistically grounded in that the most perfect representations are those that depict reality so clearly that the semiotic means are not distorting factors.” (pp. 19-20)

Collingwood (*EOPM* 1933) maintained a strict opposition between what he took to be philosophical and scientific discourse, an opposition influenced in large part by the rise of a brash new mathematical logic with a powerful new mode of conceptual rigor of great scientific attraction. A similar story could be told for the other philosophies of experience, including Continental and Pragmatic philosophies. The better part of a century later, the flourishing of mathematical logic – especially in its computational forms and behavioristic reductions of symbolic interactions – has so transformed our experience and culture as to positively invite the return and transformation of phenomenally continuous discourse to help us sort out the problems of "garbage in, garbage out." Inevitably messy, it is nonetheless time to explicitly embrace the products and achievements of the innovative countably infinite formalisms as well as the wider mathematized and technologized knowledges and practices in *terms of the newly emergent tertiary qualitative phenomena* they introduce into the varieties of life-form experiencing across the biological and cultural spectrums. We can no longer find comfort and respite behind an academic division between philosophy and science. We must accept their intermingling and develop reflectively aware hybrid modes of expression that build on both the strengths of scientifically univocal *and* scientifically polyvocal terms.

Of course, much has been left only partially determined in this neoteric return to Aristotle's productive science, or even unmentioned in the above overview despite its decidedly not short expression. Nonetheless, it does provide a fairly comprehensive statement of the recovery project at hand and its results envisioned as a whole. As we have seen in Aristotle's opening pair of sentences, the telic closure of the philosophic commonplace of [poetics | *new hybrid middle terms* | science] already lies in the <u>productive ambiguities</u> of its beginnings. New middle terms have the potential for developing and <u>performing</u> new teleological consummatory acts; these new acts aim at binding science and common sense into a more adaptive and flourishing culture through the cross-breeding of *making* and *knowing* that is long term sustainable. Such re-normalizing middle terms will have to bring telic expressiveness as well as formal precisions into both the worlds of science and common sense. The exegetical tasks behind this overview constitute the more detailed evidence and arguments for the results and interpretations developed in these three Interpretive Scenes.

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Appendix A – The Definitory Dialectic of Aristotle's Four Causes applied to Poetic Capacities
and
Their Organization of Knowledge
in
Aristotle's *Poetics*

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Aristotle's Four Causal Schematisms*

Much has been written about the four causes, but they are seldom examined as the concrete application of Aristotle's philosophic method for differentiation in his treatises. The opening five chapters of the *Poetics* are perhaps the clearest case of his use of a causal sequence of differentiations to prepare for a scientific definition. This sequence of mid-level schematic abstracts examines how Aristotle uses a scientific or philosophic dialectic to lay out the system of poetic capacities to imitate through media, form, and style analyzed as causal factors for all of poetry as "the ultimate bases of the principle" (*Topics*, I,2, 101b37) of poetics. The central argument of these chapters is a staged sequence of varying the specific capacities as poetic causation of one kind of causation while holding the others constant, along the way to the definition of tragedy as the foremost among the genres. Aristotle's scientific method for the differentiation of poems is then a definitory dialectic that organizes the primary causes of a subject matter into a system of different kinds of mutually separable variables, with genres the constant phenomena. The general development of this argument narrows from the whole of poetry to three most imitative genres, comedy, epic, and tragedy. Viewed through an extended exegesis of the text, a clear system of material, formal, efficient, and final causal factors emerged that provides "contrary" measures of different aspects of imitativeness appropriate to a productive science.

(* An earlier version was presented at the History of Science Society 2004 Annual Meeting, Friday, November 19, 2004.)

Table A-1 *First technique of comparison and contrast* (2nd Greek sentence of ch. 1.)

Contrasts of causal capacities in the Experience of the Whole of Poetic Objects
as
Instantiated by 6 Genres

Epic & Tragedy

Efficient *contrasts* arising from contrasts in manner of imitation:

Narrative (telling) vs. Dramatic (acting)

(Formal *comparisons* based in sharing a common object of imitation:

Noble Agents)

Comedy & Dithyramb

Formal *contrasts* arising from contrasts in objects of imitation:

Base Agents vs. Noble Agents

(Second-order contrast: artifactual record vs. no preservable poem)

(Material *comparisons* based in sharing of common means of imitation:

Rhythm, Language, Harmony)

Flute & Lyre Playing

Material *contrasts* arising from contrasts in means of imitation:

Wind Instruments vs. String Instruments

(Efficient *comparisons* based in sharing common manners of imitation:

Both are instrumental music, not voice alone)

Table A-2 *Second technique of comparison and contrast* (2nd half of ch. 1.)

<u>Comparisons and Contrasts in Means</u>

THE MATERIAL CAUSES OF IMITATION

(Ordered according to a hierarchy of intensity in roughly 3 degrees)

A [Degree 1.] Means used singly or in pairs

Painting	**Color & Figure**
Song	**Voice (tone)**

-----arts concerned with means as a whole found in representative six-------

Flute & Lyre	**Harmony & Rhythm**
Dance	**Rhythm**
"nameless art"	**Speech (with or without meter)**

Epic (ἐποποιία) seems to be ambiguous as both a named genre and a general word for "that which is uttered in words, speech, tale" (ἔπος, LSJ). I take it here as a transition mode sharing between Degrees 1, 2 and 3 beginning in oral tradition and carried forward when Homer's and other epic poems were ultimately written down. Much later we will get "novels."

B Rhythm, Speech, & Harmony together

[Degree 2.] All 3 at once

Dithyramb & Nome

[Degree 3.] All 3 separately

Tragedy & Comedy

The *order* and *sequence* for material causation instances a "scale of comparison and contrast" at work throughout the causal technique of differentiation. The comparisons and contrasts of kinds of art brought forward vary by cause, but each cause is ordered from lesser to higher degree.

Table A-3 *Third technique of comparison and contrast* (Ch. 2. – "objects" of imitation.)

<u>Comparisons and Contrasts in Poems according to the Character of Agent</u>

FORMAL CAUSES OF IMITATION

(Ordered according to increasing artifactual concreteness and clarity of form.)

[Groups 1 & 2 according to object, match to group 1 according to means, then group 3 to 2, and group 4 to 3.]

A 1. Each poem is <u>not</u> fixed as concrete, studiable object; each genre is equivocal with respect to the kind of agent it imitates.

Flute and Lyre Playing	**Both music and dance**
Dance	**are capable of imitating all 3 kinds of character.**

2. Each poem is fixed as a concrete, studiable object; each genre is equivocal with respect to the type of agent it imitates.

Painting

a. Pauson	**Base men**	**Painting is the least imitative of the arts with respect to moral qualities. (*Pol.*, viii, 5. 1340a 25 ff.)**
b. Dionysios	**Average men**	
c. Polygnotos	**Noble men**	

"Nameless art"* (**mimes of Sophron or Xenarchus and Socratic Conversations) ***& Epic

a. Hegemon	**Base men & actions**
b. Kleophon	**Average men & actions**
c. Homer	**Noble men & actions**

B 3. Each poem is a partially concrete object and each genre is partially identified with a certain kind of agent. (But not completely due to audience participation beyond the control of the poet.)

a. ***Nome***	**Base men & actions**
b. ***Dithyramb***	**Noble men & actions**

4. Each poem is a fully concrete object & each genre is identified with a unique kind of agent. (The genres achieve full separation from the audience.)

a. ***Comedy***	**Base men & actions**
b. ***Tragedy***	**Noble men & actions**

Table A-4 *Fourth technique of comparison and contrast* (Ch. 3. – "Manners" of imitation)

Comparisons and Contrasts of Poetic Manner

EFFICIENT CAUSES OF IMITATION

(Ordered according increasing degree of dramatic impersonation.)

1. Music and Dance	**Drop out from consideration because of not being fixed as concrete studiable objects.**

2. A HOMER

a. Narrative (or Mixed) Manner

b. Imitates Worthy People and Actions

c. Composed Epics (One of the named kinds vs. the "nameless art".)

3. Dithyramb and Nome	**Drop out from consideration because they are in part improvisatory and thus not under the full control of the poet. (1449 a 10.)**

4. B (Comedy and Tragedy are equally dramatic so the ordering puts "worthy" over "base")

SOPHOKLES

a. Dramatic Manner

b. Imitates Worthy People and Actions

c. Writes Tragedies

ARISTOPHANES

a. Dramatic Manner

b. Imitates Base People and Actions

c. Writes Comedies

Table A-5 *Fifth technique of comparison and contrast* (Chs. 4 & 5 "Teleology" of imitation.)

Comparisons and Contrasts of Poetic Pleasures:
The Final Causes of Imitation as Genre Instantiations of the
Human Universals Learning, Delight and Suffering

(Ordered according to the best or most worthy first. Same sequence as histories in ch.4- 5.)

'At Which' and 'By Which'

TRAGEDY

Means	**Shares position of most intense and yet most distinct with Comedy, (i.e., all separately).**
Object	**Distinguished for imitating worthy people and actions.**
Manner	**Shares position with Comedy for greatest separation of poet, audience, and poem presented dramatically.**

EPIC

Means	**Speech alone or with meter, yet worthiest of all means. (Originally tied closely with song.)**
Object	**Shares position with Tragedy and Comedy as either can be presented in Epic. Serious epics such as the Iliad are more noble than comedic ones.**
Manner	**Narrative manner, yet the best poets speak in the person of their characters.**

COMEDY

Means	**Shares position with Tragedy.**
Object	**Imitates base people and actions and is therefore inferior to Tragedy.**
Manner	**Shares position with Tragedy.**

Table A-6 *Sixth technique of comparison and contrast* (Summary of Definitory Dialectic up to ch. 6.)

<u>Reflexive Principle for Selection from the Whole of Poetry for The Purposes of Defining a Primary Genre</u>

(The commonplace of comparison and contrast as it functions in the whole of poetry according to the selection of a genre by an inquirer.)

<u>PROPER PLEASURE</u>

[*Final Cause*]

The Excellence of Catharsis of a Primary Genre of Art:

1. **TRAGEDY**
2. **EPIC**
3. **COMEDY**

[The human capacity to experience learning and delight through imitation]

⇓

<u>MANNER</u> ⇒	Selected Genre	⇐ **<u>OBJECT</u>**
[*Efficient Cause*]	Particular Poem	[*Formal Cause*]
The Art of the Poet		*The Art of Imitating Ethical Forms*
DRAMA (acting)		**WORTHY** PEOPLE & ACTIONS
MIXED	⇑	**AVERAGE** PEOPLE & ACTIONS
NARRATIVE (telling)		**BASE** PEOPLE & ACTIONS

<u>MEANS</u>

[*Material Cause*]

The Art of Arranging Materials

RHYTHM

SPEECH

HARMONY

In the first five chapters of the Poetics Aristotle explicitly lays out a four-fold causal analysis of the poet's agency in imitative making for the whole of poetry and its artifacts (*to súnolon*). This analysis breaks down into groups of three related phenomena on four different contraries or substantive causal capacities of imitation (mimesis) for each general kind of cause:

(Read down each column in groups of three, and across "whole chapter by whole chapter" rather than trying to draw horizontal connecting lines across causes.)

Ch. 1	Ch. 2	Ch. 3	Ch.'s 4&5
MATERIAL	**FORMAL**	**EFFICIENT**	**FINAL**
Range of: **means** ("in which")	Range of: **objects** ("of what")	Range of: **manners** ("how")	Range of: **genres produced** ("why": "at & by which")
rhythm	**worthy char.**	**dramatic**	**Tragedy**
speech	**avg. char.**	**mixed together**	**Epic**
harmony	**base char.**	**narrative**	**Comedy**

Table A-7 Exhibition of the sequence of causes and their primary contraries

Having gotten this far in the first five chapters, Aristotle goes on to give a definition of the genre of Tragedy in chapter six. There is a great debate about whether there are lost books for Comedy and Epic.

Table A-8 **Properties of Aristotle's Causal System of Poetic Capacities:**

1) Empirically tied to the phenomenal properties of a particular subject matter manifold
2) Multicausal – a system of 4 causal factors: material, formal, efficient and final
3) Multischematic – multiple contraries or categories of terms across different subject matters
4) Fully Interpenetrating [all 'contrary' ranges cover all causes]
5) Overlapping Distinctions of Degree and Kind [different kinds of genres with different degrees of: intensity, formal stability, dramaticality and proper pleasure].
6) Conceptual Coherence and Consistency across Variable Comparisons and Contrasts.
7) Permits Distinct "Covering" or "Spanning" Lines of Thought, but not "universal laws".
8) Teleological Organization (today we might say "self-organizing system" within human culture).
9) Formally Reproductive in Sequences of Coincident but Progressively Narrowing Concrete, Composite Wholes: Poetry as a whole: Genre of Tragedy: Plot in general: Kinds of Tragic Plots

Specific Exemplary Play – *Oedipus Rex*.

Properties of the Quarto model in comparison to Aristotle's System of Causes

yes 1) Tied to the limited phenomenal properties of a particular physical subject matter system

yes 2) Multicausal – four categories of qualitative – [tall | short], [round | square], [hollow | solid], [light | dark] aspects for all discrete combinations

yes 3) Multischematic – allows for simultaneous, non-conflicting schematic orderings for different concepts of "game play."

yes 4) Fully Interpenetrating [all 'contrary' ranges coincide over all causes]

no 5) Overlapping Distinctions of Degree and Kind [different kinds of genres with different degrees of: intensity, formal stability, dramaticality and ennobling pleasure] *Fails to have sufficient qualitative complexity since it only has a minimal range of concrete phenomena.*

simpler 6) Conceptual Coherence and Consistency across Variable Comparisons and Contrasts. *The four pairs of qualitative opposites constitute a much simpler System.*

yes 7) Permits Distinct "Covering" or "Spanning" Lines of Thought, but not "universal laws." (This amounts to playing the game of Quarto™.)

no 8) Teleological Organization (a "self-organizing system") – not genuinely self-organizing. The "player" has to do that. But higher level structures do emerge in two different kinds of game-play variants, roughly genres.

no 9) Formally Reproductive in Sequences of Coincident but Progressively Narrowing Concrete, Composite Wholes. *Non-teleological organization.*

Appendix B -- The first 3 chapters of Aristotle's *Poetics* in English with transliterated Greek terms.

(The full text with Greek and translation can be viewed at:

http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3atext%3a1999.01.0056

Bywater translation with a few changes. Alternate translations in square brackets. The first occurrences of specific *means* of imitation are numbered in angle brackets, <1>, while *explicitly named ways of making or arts* in the discussion of means are in **bold** and numbered within curly braces, {1}. The text is divided into segments according to the relative power or degree of imitativeness expressible in the various species.)

Chapter 1

------------1st Greek sentence: Poetics as a Whole, its Species and Powers

[1447a][8] Our subject being Poetry (*poiêtikês autês*), I propose to speak not only of the art in general but also of its species (*eidôn autês*) and their respective capacities (*dunamin*); of the structure of plot (*muthous*) required for a good poem (*poiêsis*); of the number and nature of the constituent parts (*moriôn*) of a poem (*poiôn*); and likewise of any other matters in the same line of inquiry (*methodou*). Let us follow the natural (*phusin*) order and begin with the primary facts (*tôn prôtôn*).

------------2nd Greek sentence: First Technique of Comparison and Contrast

Epic poetry (*epopoiia*) and Tragedy (*tragôidias*), as also Comedy (*kômôidia*) [and] Dithyrambic poetry (*dithurambopoiêtikê*), and most flute-playing (*aulêtikês*) and lyre-playing (*kitharistikês*), are all, viewed as a whole (*tó súnolon*), modes of imitation (*mimêseis*). But at the same time they differ from one another in three ways, either by a difference of kind in their means, or by differences in the objects, or in the manner of their imitations.

---- Material Causation [Degree 1.] **<u>Color and Figure; Voice.</u>**

I. Just as <1> form (*schêmasi*) and <2> colour (*chrômasi*) are used as means by some, who (whether by art (*technês*) [20] or constant practice (*sunêtheias*)) imitate and portray many things by their aid, and the <3> voice (*phônês*) is used by others;

---- [Degree 2.] Rhythm, Speech, & Harmony used singly or in pairs.

so also in the above-mentioned group of arts (i.e., the 6 genres), the means with them as a whole are <4> rhythm (*rhuthmôi*), <5> language [speech] (*logôi*), and <6> harmony (*harmoniai*)--used, however, either singly or in certain combinations.

A combination of rhythm and harmony alone is the means in {1} **flute-playing** and {2} **lyre-playing**, and any other arts there may be of the same description, e.g. imitative piping. [25] Rhythm alone, without harmony, is the means in the {3} **dancer's imitations** (*orchêstôn*); for even he, by the rhythms of his attitudes, may represent men's characters (*êthê*), as well as what they do and suffer (*pathê kai praxeis*). There is further an art which imitates by {4} **language alone** (*logois psilois*), without harmony, in prose or in verse, and if in verse, either in some one or in a plurality of <7> meters (*metrois*). [1447b] This form of imitation is to this day without a name (*anônumoi*). We have no common name for [10] a {5} **mime** (*mimous*) of Sophron or Xenarchus and a Socratic Conversation; and we should still be without one even if the imitation in the two instances were in trimeters or elegiacs or some other kind of verse--though it is the way with people to tack on 'poet' to the name of a metre, and talk of elegiac-poets and epic-poets, thinking that they call them poets not by reason of the imitative nature of their work, [15] but indiscriminately by reason of the metre they write in. Even if a theory of medicine or physical philosophy be put forth in a metrical form, it is usual to describe the writer in this way; Homer and Empedocles, however, have really nothing in common apart from their metre; so that, if the one is to be called a poet, the other should be [20] termed a physicist rather than a poet. We should be in the same position also, if the imitation in these instances were in all the metres, like the Centaur (a {6} **rhapsody** (*rhapsôidian*) in a medley of all metres) of Chaeremon; and Chaeremon one has to recognize as a poet. So much, then, as to these arts.

---- [Degree 3.] Rhythm, Speech, & Harmony specialized to Rhythm, Song, & Meter
------------- [3a.] All 3 at once

There are, lastly, certain other arts, which [25] combine all the means enumerated, rhythm, <8> melody [song] (*melei*) , and verse [meter] (*metrôi*), e.g. {7} **Dithyrambic** and {8}

Nomic (*nomôn*) poetry, {9} **Tragedy** and {10} **Comedy**; with this difference (*diaphoras*), however, that the three kinds of means are in some of them all employed together,

------------ [3b.] **All 3 Separately**

and in others brought in separately, one after the other. These elements of difference in the above arts I term the means of their imitation.

Chapter 2

---- Formal Causation (See Appendix A for breakdown according to Degrees.)

II. The objects the imitator represents are actions, with agents who are necessarily either good men or bad—the diversities of human character being nearly always derivative from this primary distinction, since the line between virtue and vice is one dividing the whole of mankind. It follows, therefore, that the agents represented must be either above our own level of goodness, or beneath it, or just such as we are in the same way as, with the painters, the personages of Polygnotus are better than we are, those of Pauson worse, and those of Dionysius just like ourselves. It is clear that each of the above-mentioned arts will admit of these differences, and that it will become a separate art by representing objects with this point of difference. Even in dancing, flute-playing, and lyre-playing such diversities are possible; and they are also possible in the nameless art that uses language, prose or verse without harmony, as its means; Homer's personages, for instance, are better than we are; Cleophon's are on our own level; and those of Hegemon of Thasos, the first writer of parodies, and Nicochares, the author of the *Diliad*, are beneath it. The same is true of the Dithyramb and the Nome: the personages may be presented in them with the difference exemplified in the ... of ... and Argas, and in the Cyclopses of Timotheus and Philoxenus. This difference it is that distinguishes Tragedy and Comedy also; the one would make its personages worse, and the other better, than the men of the present day.

Chapter 3

---- Efficient Causation (See Appendix A for breakdown according to Degrees.)

III. A third difference in these arts is in the manner in which each kind of object is represented. Given both the same means and the same kind of object for imitation, one may either (1) speak at one moment in narrative and at another in an assumed character, as Homer does; or (2) one may remain the same throughout, without any such change; or (3) the imitators may represent the whole story dramatically, as though they were actually doing the things described.

As we said at the beginning, therefore, the differences in the imitation of these arts come under three heads, their means, their objects, and their manner.

So that as an imitator Sophocles will be on one side akin to Homer, both portraying good men; and on another to Aristophanes, since both present their personages as acting and doing. This in fact, according to some, is the reason for plays being termed dramas, because in a play the personages act the story. Hence too both Tragedy and Comedy are claimed by the Dorians as their discoveries; Comedy by the Megarians—by those in Greece as having arisen when Megara became a democracy, and by the Sicilian Megarians on the ground that the poet Epicharmus was of their country, and a good deal earlier than Chionides and Magnes; even Tragedy also is claimed by certain of the Peloponnesian Dorians. In support of this claim they point to the words 'comedy' and 'drama'. Their word for the outlying hamlets, they say, is comae, whereas Athenians call them demes—thus assuming that comedians got the name not from their *comoe* or revels, but from their strolling from hamlet to hamlet, lack of appreciation keeping them out of the city. Their word also for 'to act', they say, is *dran*, whereas Athenians use *prattein*.

So much, then, as to the number and nature of the points of difference in the imitation of these arts.

Appendix C – Transliterated Greek for the first 3 chapters.

-----------1st sentence: Poetics as a Whole, its Species and Powers

[1447a][8] peri poiêtikês autês te kai tôn eidôn autês, hên tina dunamin hekaston echei, kai pôs dei sunistasthai tous muthous [10] ei mellei kalôs hexein hê poiêsis, eti de ek posôn kai poiôn esti moriôn, homoiôs de kai peri tôn allôn hosa tês autês esti methodou, legômen arxamenoi kata phusin prôton apo tôn prôtôn.

-----------2nd sentence: First Technique of Comparison and Contrast

epopoiia dê kai hê tês tragôidias poiêsis eti de kômôidia kai hê dithurambopoiêtikê kai tês [15] aulêtikês hê pleistê kai kitharistikês pasai tunchanousin ousai mimêseis to sunolon: diapherousi de allêlôn trisin, ê gar tôi en heterois mimeisthai ê tôi hetera ê tôi heterôs kai mê ton auton tropon.

-----------A. Specific Means used singly or in pairs. [Degree 1.]

(Ways of making are indicated by numbers in curly braces and bold, {1}; means by underlining. Painting {(1)} and song {(2)} are implied by their means.)

---- [Degree 1.] Color and Figure; Voice.

hôsper gar kai **{(1)}** chrômasi kai schêmasi polla mimountai tines apeikazontes hoi men [20] dia technês hoi de dia sunêtheias, heteroi de dia tês **{(2)}** phônês**,**

---- [Degree 2.] Rhythm, Speech, & Harmony used singly or in pairs.

houtô kan tais eirêmenais technais hapasai men poiountai tên mimêsin en {group reference} *rhuthmôi kai logôi kai harmoniai*, toutois d' ê chôris ê memigmenois: hoion harmoniai men kai rhuthmôi chrômenai monon hê te **{3} aulêtikê** kai hê **{4} kitharistikê** kan ei tines [25] heterai tunchanôsin ousai toiautai tên dunamin, hoion hê tôn suringôn, autôi de tôi rhuthmôi [mimountai] chôris harmonias hê tôn **{5} orchêstôn** kai gar houtoi dia tôn schêmatizomenôn rhuthmôn mimountai kai êthê kai pathê kai praxeis:

hê de [epopoiia] monon tois **{6} logois psilois** hê tois [1447b][1] metrois kai toutois eite mignusa met' allêlôn eith' heni tini genei chrômenê tôn metrôn anônumoi tunchanousi mechri tou nun: ouden gar an [10] echoimen onomasai koinon tous Sôphronos kai Xenarchou mimous kai tous Sôkratikous logous oude ei tis dia trimetrôn ê elegeiôn ê tôn allôn tinôn tôn toioutôn poioito tên mimêsin. plên hoi anthrôpoi ge sunaptontes tôi metrôi to poiein elegeiopoious tous de epopoious onomazousin, ouch hôs [15] kata tên mimêsin poiêtas alla koinêi kata to metron prosagoreuontes: kai gar an iatrikon ê phusikon ti dia tôn metrôn ekpherôsin, houtô kalein eiôthasin: ouden de koinon estin Homêrôi kai Empedoklei plên to metron, dio ton men poiêtên dikaion kalein, ton de phusiologon mallon ê [20] poiêtên: homoiôs de kan ei tis hapanta ta metra mignuôn poioito tên mimêsin kathaper Chairêmôn epoiêse Kentauron miktên rhapsôidian ex hapantôn tôn metrôn, kai poiêtên prosagoreuteon. peri men oun toutôn diôristhô touton ton tropon.

----------B. Rhythm, Speech, & Harmony together

---- [Degree 3a.] All 3 at once

eisi de tines hai pasi chrôntai tois eirêmenois, legô de hoion rhuthmôi kai melei kai metrôi**,** hôsper hê te tôn **{7} dithurambikôn** poiêsis kai hê tôn **{8} nomôn** kai

---- [Degree 3b.] All 3 Separately

hê te **{9} tragôidia** kai hê **{10} kômôidia**: diapherousi de hoti hai men hama pasin hai de kata meros. tautas men oun legô tas diaphoras tôn technôn en hois poiountai tên mimêsin.

Chapter 2: (Note: {2} Song not mentioned; dance renumbered to {5}.)

[1448a][1] epei de mimountai hoi mimoumenoi prattontas, anankê de toutous ê spoudaious ê phaulous einai ta gar êthê schedon aei toutois akolouthei monois, kakiai gar kai aretêi ta êthê diapherousi pantes, êtoi beltionas ê kath' hêmas ê cheironas ê kai toioutous, hôsper hoi **{1} grapheis**: Polugnôtos men gar kreittous, Pausôn de cheirous, Dionusios de homoious eikazen. dêlon de hoti kai tôn lechtheisôn hekastê mimêseôn hexei tautas tas diaphoras kai estai hetera tôi hetera mimeisthai touton ton tropon. kai gar en **{3 => 5} orchêsei** kai **{3} aulêsei** kai **{4} kitharisei** esti genesthai tautas tas anomoiotêtas, kai [to] peri tous **{6} logous de kai tên psilometrian**, hoion Homêros men beltious, Kleophôn de homoious, Hêgêmôn de ho Thasios tas parôidias poiêsas prôtos kai Nikocharês ho tên Deiliada cheirous: homoiôs de kai peri tous **{7} dithurambous** kai peri tous **{8} nomous**, hôsper †gas† Kuklôpas Timotheos kai Philoxenos mimêsaito an tis. en autêi de têi diaphorai kai hê **{9} tragôidia** pros tên **{10} kômôidian** diestêken: hê men gar cheirous hê de beltious mimeisthai bouletai tôn nun.

Chapter 3.

eti de toutôn tritê diaphora to hôs hekasta toutôn mimêsaito an tis. kai gar en tois autois kai ta auta mimeisthai estin hote men apangellonta, ê heteron ti gignomenon hôsper Homêros poiei ê hôs ton auton kai mê metaballonta, ê pantas hôs prattontas kai energountas †tous mimoumenous†. en trisi dê tautais diaphorais hê mimêsis estin, hôs eipomen kat' archas, en hois te kai hôs.

hôste têi men ho autos an eiê mimêtês Homêrôi Sophoklês, mimountai gar amphô spoudaious, têi de Aristophanei, prattontas gar mimountai kai drôntas amphô. hothen kai dramata kaleisthai tines auta phasin, hoti mimountai drôntas. dio kai antipoiountai tês te tragôidias kai tês kômôidias hoi Dôrieis tês men gar kômôidias hoi Megareis hoi te entautha hôs epi tês par' autois dêmokratias genomenês kai hoi ek Sikelias, ekeithen gar ên Epicharmos ho poiêtês pollôi proteros ôn Chiônidou kai Magnêtos: kai tês tragôidias enioi tôn en Peloponnêsôi poioumenoi ta onomata sêmeion: autoi men gar kômas tas perioikidas kalein phasin, Athênaious de dêmous, hôs kômôidous ouk apo tou kômazein lechthentas alla têi kata kômas planêi atimazomenous ek tou asteôs:

[1448b][1] kai to poiein autoi men dran, Athênaious de prattein prosagoreuein. peri men oun tôn diaphorôn kai posai kai tines tês mimêseôs eirêsthô tauta.

Appendix D1 – 3 Formally Equivalent Arrangements for 3 Complete Boards of Quarto Pieces in Model *β* that Underlie Aristotle's Three Powers of Poetic Imitating at Work in Differentiating Species of Art in Model *α*.

It is quite complex to deal with the combinations for arranging Quarto pieces into rows and columns on the Quarto board according to their pairs of contrary qualities, such as [light | dark] and [solid | hollow], and then dealing with the permutations of these rows and columns allowed by placing them in different sequences of rows or columns. I will try to minimize the possible confusions, but they are intrinsic to the model. The primary point is that amidst all the possibilities there emerges an interesting and simple pattern; viz., when all the 16 pieces are put into a complete orderly arrangement by their contrary qualities on the game board, there turns out to be only three distinct ways to do this depending on which pairs of properties are selected as the basis for putting them all into a complete order.

Proceeding in a logical way, we can identify those three distinct but formally equivalent ways as they emerge from the 4 pairs of contraries: [Light | Dark], [Hollow | Solid], [Short | Tall], and
[Round | Square]. Each of the 16 game pieces presents 4 qualities with 1 quality selected from each of the contraries. Thus, each piece is both unique in its particular combination and nonetheless part of an overall system of variants. The problem at hand is how can all 16 of these unique pieces be arranged to present an overtly perceptible holistic arrangement?

If we begin with the [light | dark] contrary as our ordering selection, we get this list of 16 pieces:

LIGHT/round/short/solid
LIGHT/round/short/hollow
LIGHT/round/tall/solid
LIGHT/round/tall/hollow

DARK/round/short/solid
DARK/round/short/hollow
DARK/round/tall/solid
DARK/round/tall/hollow

LIGHT/square/short/solid
LIGHT/square/short/hollow
LIGHT/square/tall/solid
LIGHT/square/tall/hollow

DARK/square/short/solid
DARK/square/short/hollow
DARK/square/tall/solid
DARK/square/tall/hollow

Choosing a different contrary as a starting point would result in a rearrangement of the list.

By focusing on the pairing, not of a single contrary, but on selections from two contraries as in Light/Round or Dark/Square, etc., we can see from the above that there are only 4 possible pieces beginning with those different contraries. Furthermore, if we take [Light | Dark] and [Round | Square] as cross-determining possible combinations, we can see that each selection uniquely determines 4 of the 16 pieces, as again can be read from the above listing. But sticking with [Light | Dark] as a base contrary, there are two other contraries that could be chosen as a second base pair: [Short | Tall] or [Hollow | Solid]. Following this sequence of variants out, we find that there are three distinct possible basis arrangements, A, B, and C, which provide all 16 piece combinations:

Basis A Rows	Basis B Rows	Basis C Rows
LIGHT/SOLID – 4	LIGHT/SHORT – 4	LIGHT/ROUND – 4
LIGHT/HOLLOW – 4	LIGHT/TALL – 4	LIGHT/SQUARE – 4
DARK/SOLID – 4	DARK/SHORT – 4	DARK/ROUND – 4
DARK/HOLLOW – 4	DARK/TALL – 4	DARK/SQUARE – 4

Table D1-1 The Three Equivalent Quality-Bases for a Complete Ordering of the Board

Each of these bases for row determination, forces a corresponding set of columns. For example, Basis A forces columns for: SHORT/ROUND | TALL/ROUND | SHORT/SQUARE | TALL/SQUARE. Nonetheless within that forced complete order there are still additional degrees of freedom that allow minor rearrangements that do not change the overall ordering. For example, in Basis A the first row is LIGHT/SOLID, but there are still 4 pieces that meet that requirement and their order in sequence has its own combinatoric and so on for all the rows and columns. See Fig. D1-4 below.

These 12 pairings in can then be exhaustively arranged in three mutually exclusive ways depending on which initial pairing is chosen as ordering rows, and which pair is chosen as ordering columns:

Complete Ordered Board 1

Rows
LIGHT/SOLID
LIGHT/HOLLOW
DARK/SOLID
DARK HOLLOW
crossed with
Columns
SHORT/ROUND
TALL/ROUND
SHORT/SQUARE
TALL/SQUARE

Row Basis A

Fig. D1-1 – Complete Ordered Board 1

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Complete Ordered Board 2 - **Row Basis B**

Rows
LIGHT/SHORT
LIGHT/TALL
DARK/SHORT
DARK/TALL
crossed with
Columns
ROUND/SOLID
ROUND/HOLLOW
SQUARE/SOLID
SQUARE/HOLLOW

Fig. D1-2 – Complete Ordered Board 2

Complete Ordered Board 3 – **Row Basis C**

Rows
LIGHT/ROUND
LIGHT/SQUARE
DARK/ROUND
DARK/SQUARE
crossed with
Columns
SHORT/SOLID
SHORT/HOLLOW
TALL/SOLID
TALL/HOLLOW

Fig. D1-3 – Complete Ordered Board 3

On the determinate side, each of these "complete" orderings for all 16 on the whole board is unique in that each of the ordering pairings occurs once and only once throughout all three total orderings. So, for example, LIGHT/SOLID occurs as the first *row* in the first grouping above and nowhere else in the rows or columns of the three orderings. Similarly, for LIGHT/SHORT in board 2, and LIGHT/ROUND in board 3. In fact, this property holds for all 24 unique beginning pairings as rows and columns. It thus emerges that there are three and only three complete orderings possible on the board.

What is still not determinate about these three complete orderings is that the sequences for each complete board are still *free to vary in the sequences for rows and columns.* Thus, there is a further combinatoric in which, say, the first row in Board 1 has a different place in the sequence of rows. In the image below, what was the 1st row in Board 1 as LIGHT/SOLID is now located as the 3rd row *in the same complete organization*:

Fig. D1-4 – Remaining degrees of freedom in the boards

Moreover, any given grouping of 4 pieces as a row or column for a given determinate board could occur at any location in the sequences of the rows and columns. This property gives us a sense of how there are degrees of freedom beyond those determined by the basis selection of alternate pairs for a given board.

Returning to the primary point with regard to Aristotle's use of three poetic capacities to give order and arrangement to the causal differentiation of poetic species, we can see there is an underlying formal coherence to Aristotle's combinatoric even as it succeeds at grasping the complex whole of all the poetic qualities in ways that model β cannot. For Aristotle, it is the fourth and final cause that brings about the functional relationships that actually systematize poetics-itself and its species-themselves.

Appendix D2 – Enumeration of the Large Finite Combinatorics for Two Quarto Properties: “Round” and “Square” intrinsic to playing the game.

Sample output from small program for generating these Quarto combinations. http://www.pdthomas.com/4qp/lock-quality.html. The program generates the eight possible groups of “winning strategies” wherein a single qualitative property such as Round or Hollow is shared by four pieces. There is a total of 16 pieces that have been numbered in hexadecimal notation from 1 to F. The numbers of each of the four pieces combined into a *winning four* is located in the top left corner of each combination. My sincere thanks and appreciation go to Philip D. Thomas for collaborating in creating this program.

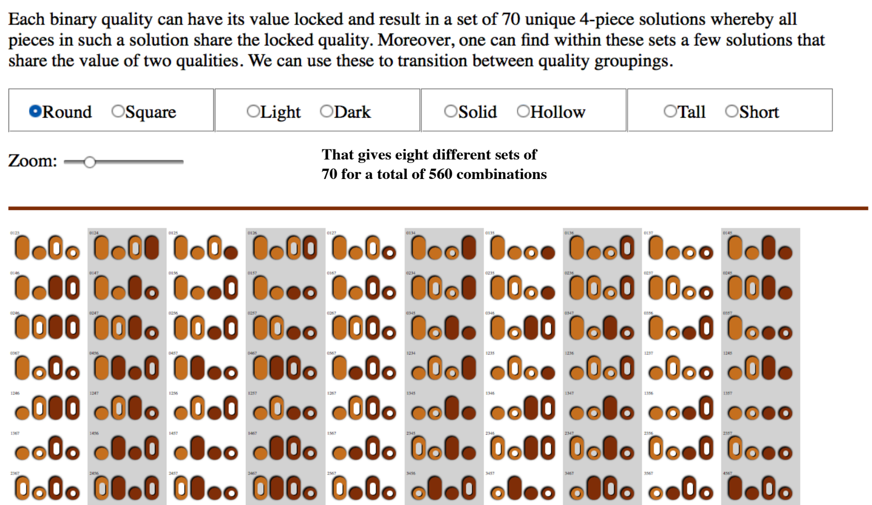

Fig. D2-1 – Complete combinatoric for 80 groups of 4 based on the “round” quality

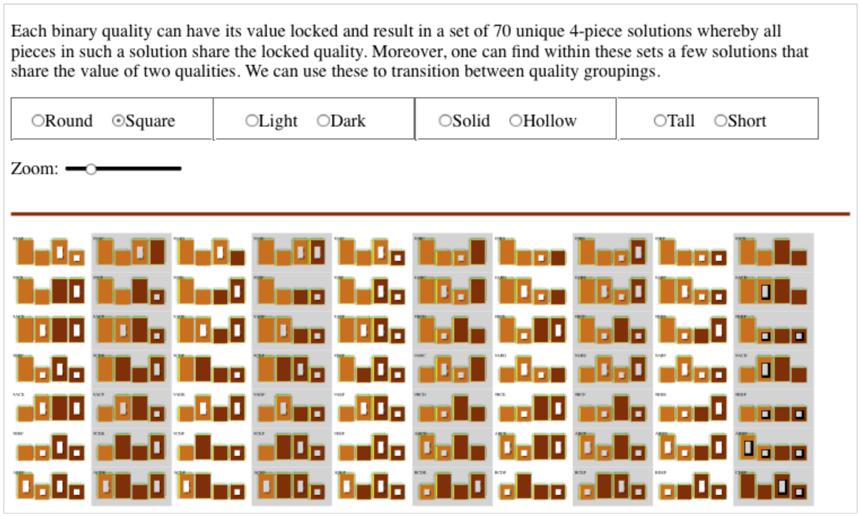

Fig. D2-2 – Complete combinatoric for 80 groups of 4 based on the “square” quality

Endnotes

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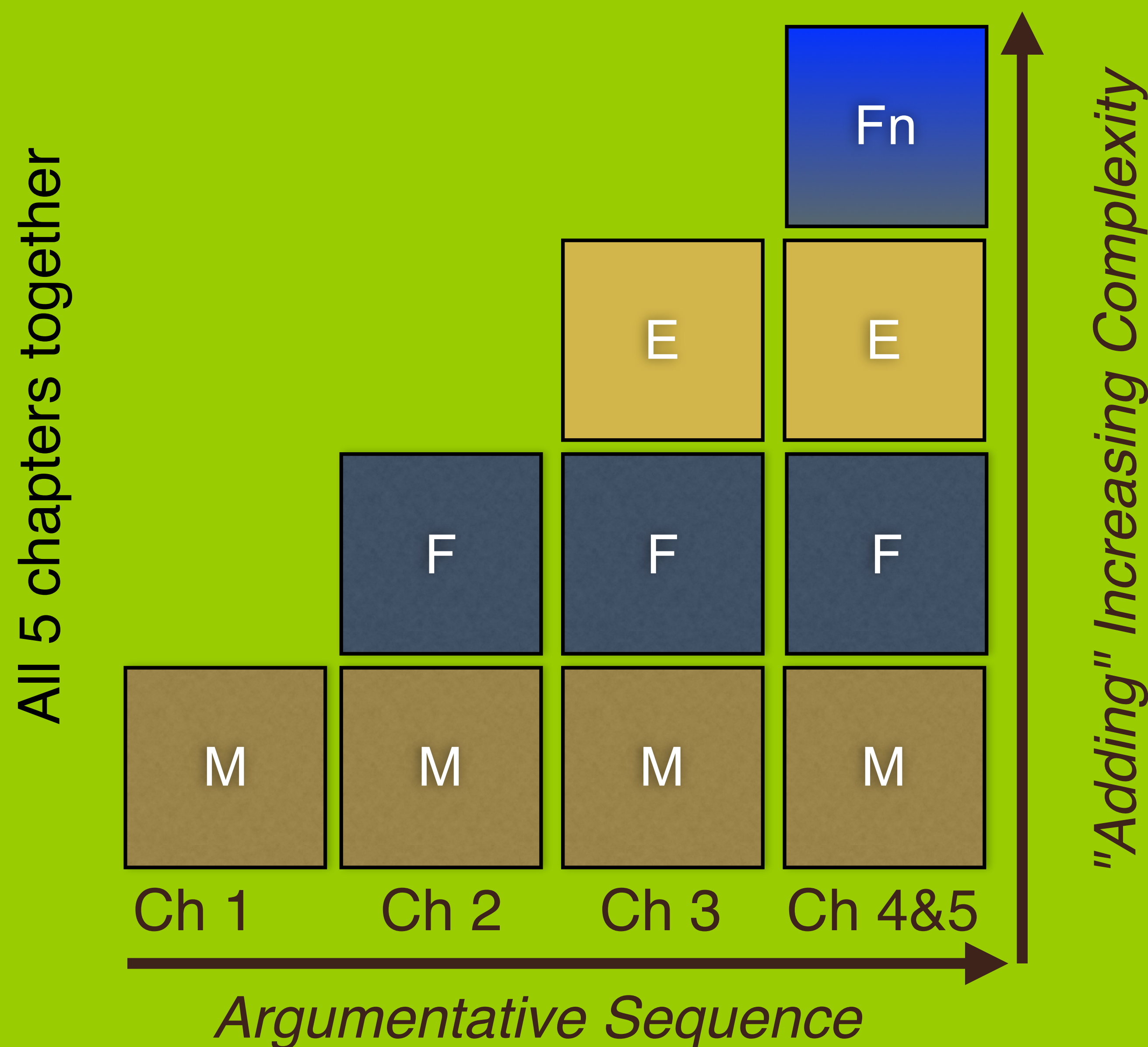
[i] As early as 1961, Ernst Mayr made use of the concept of computer procedures: "An individual who — to use the language of the computer — has been "programmed" can act purposefully. … A programmed computer itself is an "individual" in this sense, …" (Mayr 1961, p. 1054.) In Mayr 1974, "Teleological and teleonomic. A new analysis," we find a more expansive analysis of "teleology" that includes the creation of artifacts such as beavers building a dam. Whereas in Mayr 1992, "The Idea of Teleology," he retracts the inclusion of artifacts from within the range of a 'teleonomic' act. In the latter, Mayr claims an increased warrant in the notion of a deterministic "program" that provides a control for some biological process taking place for some purpose such as maturation from fetus to a viable living creature with the proviso that a "program" is not itself conceived as teleological.

> All teleonomic behavior is characterized by two components. It is guided by a 'program' and it depends on the existence of some end point, goal, or terminus which is foreseen in the program that regulates the behavior. This endpoint might be a structure, a physiological function, the attainment of a new geographical position, or a 'consummatory' (footnote: Craig, 1918 [which gives a "purely behavioristic meaning" in terms of "appetites" and "aversions," p. 91.]) act in behavior. Each particular program is the result of natural selection, constantly adjusted by the selective value of the achieved endpoint.
>
> The key word in the definition of teleonomic is *Program*. The importance of the recognition of the existence of programs lies in the fact that a program is (1) something material and (2) something existing prior to the initiation of the teleonomic process. This shows that there is no conflict between teleonomy and causality (Mayr 1992, p. 12).

Such a "program" is non-conscious in the same way that a computer program is at best a form of non-conscious cognition very roughly like the formation of the visual field prior to perception (Hayles 2015, Critical Inquiry Lectures: Nonconscious Cognition and Material Processes, 2012, *How We Think*). Hayles assimilates computing to "cognitive assemblages" as ensembles engaged when "humans and cognitive technical systems interact." (Hayles 2017. *Unthought: The Power of the Cognitive Nonconscious*, April, 2017.) For Mayr, only the actual occurring process *as the execution of a program* may have a goal. This puts too much trust in the "mechanical objectivity" of a computer program and in the significance of a halted computation. This is especially evident in our current understanding the inadequacies of using a "program" as a strict model for "running DNA." In fact, and intentionally so for Mayr as a biological scientist, neither of these determinations of "*teleonomic* consummatory acts" includes a full picture of what a human being's full range of life activities consist of. Modern biology does not yet afford us a coherent way of treating issues of living a "flourishing" (*eudaimonia*) life. From the viewpoint of reductive biological science such a goal is at best a promissory note with a very long lead time. Because of the explicit analogy to computing, one might specifically say a "countably infinite" lead time. Yet the term "teleonomic consummatory act" has great attraction because of its possible unification of biology, cognitive and social science, and culture within the scope of actual human activities, if only we allow ourselves to presuppose that *culture* and *community* are intrinsic to human existence as social (Dunbar 1998, 2008, and many others), and that *culture* and *community* are as much a part of our "nature" as our genetic code or a drive to reproduce. We need to maintain the stability and rigor of such scientific terms with their hard scientific goals of "command and control," but we also have to realize that those same terms have a much wider range of significances as they become "naturalized" in their full range of effects in the physical, biological and cultural worlds that they affect.

Complementary to Mayr, as it seems plausible he would accept the use of "teleological" with reference to Aristotle, we can no longer afford to relegate catharsis to the label "teleological" in its current use as a disparaging term primarily because evolution is not deemed to be "purposive" when taken to be a strictly "physicochemical" process. That would be to abandon our humanly intrinsic needs for society and dignity to a "bit bucket" (i.e., "a logical space where lost, deleted or unrecoverable data goes" (*techopedia.com*)). At the same time, we also cannot afford to abandon the rigor of modern sciences that are gradually coming to recognize those needs even as those very same sciences are powerfully changing our human conditions, and thereby originating new needs and desires. It may be that this apparent diremption can in part be freshly integrated by beginning a new appreciation of the hidden observational and conceptual rigors of ancient philosophical science with its powerful modes of discursively coherent qualitatively concrete reference even as our sciences enter the same realms.

Additional care in this reinterpreted, more polysemic use of the portmanteau term 'teleological consummatory act' is still required. The above posits neither indicate that "vitalism" as some external power or force is at work in purposive activity, nor that all cultures must have a concept of tragedy per se, nor that all individuals must experience a given catharsis. Rather, the stance that tragic catharsis asserts about the consummations of human nature are in practice a metapragmatically active telos (Felson and Parmentier, 2015). It asserts that poets actually aim at or abduct the enactment of such a telos as poetic possibilities which are as real a part of humanity's biological legacy as they are of any particular cultural legacy. After all, isn't the very pursuit and successful determination of knowledge itself a "teleological consummatory act" that we desire with its own peculiar satisfactions in this wider sense?


All 5 chapters together
Fn
E
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M
M
Ch 1
Ch 2
Ch 3
Ch 4&5
Argumentative Sequence
"Adding" Increasing Complexity