

The Limit of Explanation: Following the "Why" to its Epistemological Terminus

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The Search for Explanation

In this essay I will examine the theory and praxis of explanation and demonstrate the unsustainable character of its claims and underlying presuppositions. My involvement in this project stemmed originally from my interest in contributing to a development of a formal methodology in the humanities. The methodology of the sciences is well established today and is based on a set of accepted tenets that serve as guidelines in scientists' pursuit of theories. As Michael Ruse puts it:

Surveying science and the history of science today, one thing stands out: science involves a search for order. More specifically, science looks for unbroken, blind, natural regularities (laws). Things in the world do not happen in just any old way. They follow set paths, and science tries to capture this fact. Bodies of science, therefore, known variously as 'theories' or 'paradigms' or 'sets of models' are collections of laws (PS 39).

Among the governing principles, scientists single out explanation, prediction, testability, and non-falsifiability as the most salient. Explanation usually comes first, as nearly all scientific quests start as attempts to explain physical phenomena. It has a symmetrical facet--that of prediction. In other words, to understand an empirical phenomenon from a scientific point of view means to have cognizance of a certain law-like physical regularity such that the phenomenon can both be explained and predicted. The distinction between the two activities bears the pragmatic character of what the questioner knows first: that the phenomenon has already occurred--and thus he has to furnish its explanation--or that necessary antecedent conditions obtain--in which case, he can deduce its occurrence. Thus the sight of a baseball flying in the direction of a window makes me anticipate the sound of shattered glass coming closely on its heels, while if I see and hear a window being broken, I immediately start looking for its human or natural source (my familiarity with this phenomenon would include the implicit knowledge of the law of the conservation of momentum and the low shock-resistance of glass).

As we make a transition to less precise disciplines--first to the social sciences, then to the humanities--the role of explanation and prediction grows progressively more dim. In the humanities, we no longer expect perfect predictive validity from theoretical claims, but this does not mean that the explanatory principle has been rendered irrelevant. Although the use of the term "explanation"

itself is not as explicit as it is in science, the explanatory enterprise still serves as the animating impetus behind many activities. Whether tracing through textual interpretation how a text can be brought into a correspondence with another text, or engaging in deconstructive and cultural criticism informed by the workings of language, we implicitly assume that the insights we have gleaned from our analyses have more than just local value. We expect, in fact, that in some way, they have broadened our understanding of the subject and that the next time around, we will be shrewder at spotting pertinent rhetorical figures or semantic features. We still aim at some regularity of knowledge, still hanker after some sort of an illumination. But predictiveness of the humanistic kind is loose and empirically contingent on given context, in contradistinction to reliable predictions supplied by scientific theories. And what form is our illumination to take? What kind of an understanding can we cull from the imprecise humanistic disciplines? If what we know is not sufficiently general or categorizable to yield a cogent prediction under some systematic method of interrogation, can it still be summarized and conveyed in an explanation, and if so, to what kind of an explanation would it be amenable?

To try to clarify these questions for myself, I set out to investigate scientific explanation, which constitutes an already established discourse with a set of defined issues and standard arguments. I made a foray into the philosophy of science in the hope of gaining some valuable perspective that would allow me to transfer relevant insights and outline a legitimate explanatory problematic in the humanities. To my surprise, I discovered that explanation in the sciences is far from a resolved matter but presents an ongoing debate with several competing models. Each model attempts to overcome the obstacles that other models run up against, but in so doing, it reveals weaknesses of its own. The main problem rests with the philosophical difficulties of articulating formal explanatory criteria. These difficulties in each particular case are either ignored or settled by resorting to an intuitive understanding of explanatoriness. The unexamined appeal to intuition that underpins the scientific discourse indicates to me that, perhaps, the problematic of explanation transgresses or does not even properly belong to the domain of science. Perhaps the real question instead is what lies behind this circumvention of reason and falling-back on the explanatory "sensation," which makes it no longer a scientific issue, but a humanistic one. In this case, the focus is no longer on the methodologies in the humanities but on redefining explanation as an anthropological project.

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In the following argument, I will present an overview of the existing theories of explanation in philosophy of science together with their critique, followed by a concluding section on the anthropological implications of the explanatory discourse's failure, which I will connect to some relevant theoretical points of generative anthropology. Those who wish to skip the technical part can fast-forward to the last subdivision of this article, entitled "The Anthropological Content." Alternatively, those who do not want to wade through the entire technical argument but want to get some idea about the limit of explanation should go directly to the section on "The Breakdown of Functional and Genetic Explanations." I have structured my exposition historically, starting with the two standard competing accounts of explanation--those of the covering law and of causation,

represented by Carl Hempel and Wesley Salmon, respectively. I then follow with several alternative explanatory paradigms--the pragmatic model of Bas van Fraassen, the capacities model of Nancy Cartwright, and the schematic account of Philip Kitcher. Finally, I present functional and genetic explanations in evolutionary biology, exemplified by the views of Larry Wright and Robert Cummings. I dwell on these theories in great detail, because I view them as crucial for understanding how a scientific issue becomes a problematic in the humanities.

The Covering-Law Theory: First Attempt at Scientific Explanation

The modern scientific theory of explanation begins with Carl Hempel and Paul Oppenheim's 1948's essay "Studies in the Logic of Explanation," which to this day remains highly influential: more recent writing has defined itself mainly as a response to the ideas set forth in the authors' original position. The article begins by stating that explanation is an answer to the why-question (in contradistinction to the what-question, which prompts rather a description of a phenomenon in question). In a later essay, Hempel provides a "mini-anthropology" as a frame for his largely formal-logical investigation. The need for explanation, he contends, stems from "two enduring human concerns," one practical and the other idealistic. The practical aspect has to do with "man's quest for foresight and control," which "makes it important for him to find reliable ways of foreseeing changes in his environment and if possible, controlling them to his advantage." The idealistic motive "lies in his sheer intellectual curiosity, in his deep and persistent desire to know and to understand himself and his world" (ASE 333).

The basic schema of explanation outlined by Hempel and Oppenheim's article goes as following. Explanation as an answer to a why-question, they maintain, is an argument that logically deduces the *explanandum* (the description of a phenomenon to be explained) from the *explanans* (general laws and specific antecedent conditions which account for the phenomenon). One of the illustrations given is that of the bent appearance of an oar under water (or a spoon in a cup of tea). If the questioner wants to know why this is so, an appropriate explanatory response would list the general laws in this case, such as the law of refraction and the relative difference between the densities of water and air, and mention the antecedent conditions, namely a straight wooden object located partly in the water, partly in the air.

The above is an example of a deductive argument--a conclusion that can be logically deduced. There are also inductive arguments, whose validity we demonstrate by an inferential appeal to some known statistical regularity. One could, for instance, ask why there occurred a sudden price drop at the US cotton exchanges. An explanation of this fact would invoke the economic law of supply and demand and the antecedent conditions of there being a sudden large accumulation of cotton stocks (appealing to the logic that when there exists no appreciative rise in demand for a good, increased supply should cause its price to plummet). Another example would be asking for an explanation as to why this particular patient has successfully recovered from a streptococcal infection. A reasonable explanation would mention that the penicillin has been administered to the patient, and that penicillin treats the streptococcal infection with a high degree of statistical

probability. In other words, when there exists a reasonably high likelihood that a certain anticipated event will come to pass, a well-established statistical regularity can be used in place of a general law.

A general law could also be subsumed under a another, more general law. One could question why the propagation of light obeys the law of refraction and answer this question by pointing out that all wave phenomena are subject to refraction, and light is a wave phenomenon. Because the pivotal part of the explanatory argument constitutes an appeal to a general law or a set of general laws which are required for the derivation of the *explanandum*, the explanatory schema set forth by Hempel and Oppenheim came to be known as the covering-law conception of scientific explanation.

Hempel and Oppenheim also look at motivational and teleological explanations and dismiss both. The motivational explanation is an answer to the question of the type: "why did John buy fish?"--"because he wanted to have fish for dinner." But as the authors explain, to assign a motivation to an actor is functionally indistinguishable from explaining the action causally: the person's wish or belief can be postulated as a statistical law (John's desire for fish made him do it), while the goal itself could be ignored, since at the moment of the action, there is no certainty that the goal may ever be reached. (Some historical explanations are not uncommonly framed in motivational terms: "Why did Hitler invade Poland? Because he believed that by doing so, he would attain such-and-such strategic goal.")

Teleological explanations are somewhat trickier. Even if one discounts the teleological explanation in its traditional, now archaic, form of the Creator purposefully creating the thing in question, there remains the widely used "functional" explanation in evolutionary biology. Functional explanation responds to the question of why a certain feature is there: for example, "why a jack-rabbit has long ears" or "why human blood has red corpuscles" or "why mimicry exists in nature." A common answer--"in order to effect this and that" (e.g., assist thermoregulation)--is teleological in character insofar as it implicitly presupposes a purpose in its formulation. Evolutionary biologists have since argued that it is possible to couch functional explanation in non-teleological terms, amounting to a claim about evolutionary advantage. However, I believe Hempel and Oppenheim's criticism of this argument to be valid, as I will demonstrate in "The Breakdown of Genetic and Functional Explanation" section below.

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When functional explanation is stripped of teleology, it tends to be presented as an account of how a certain adaptive mechanism developed (e.g., "one jackrabbit was born with large ears, which proved to be superior in controlling its body temperature, because larger ears contained more blood vessels that could be dilated in hot weather, radiating more heat and thus cooling the animal more efficiently; those descendants of this jackrabbit who inherited this characteristic survived in larger numbers, because they had an adaptive advantage; as a result, the entire population of

jackrabbits came to possess large ears"). In this narrative form, functional explanation merges with the class of genetic explanations. A genetic explanation "that consists in telling a story leading up to the event to be described" (SE 32) is invoked in evolutionary theory, cosmology, geology, and history, among other disciplines. This type of explanation deals with emergent phenomena, *i.e.*, phenomena that can be described as principally novel or unexpected, because their occurrence cannot be predicted based on the available information: they can neither be logically inferred from the immediately preceding state of the system nor surmised from the consideration of its constitutive parts. In giving a genetic explanation, one thus recounts a narrative of how something came to pass. Thus in explaining the Universe, one tells the story of its origin, starting with the Big Bang; in explaining the appearance of a new species, one tells the story of Darwinian selection.

Some Objections to the Covering-Law Theory

Even though the covering-law thesis (with later enhancements and modifications) remains widely accepted in the scientific community, it was met with several serious challenges soon after its publication. One important issue that it raised was its unexamined concept of a general law. Can a general law be defined and thus distinguished from a merely accidental generalization? This, it turns out, is far from a trivial task. A famous counterexample is that of a barometer. When we observe a sharp drop in barometric pressure, we know with a high degree of certainty that a storm is coming. It could be said that a correlation between weather and barometric reading constitutes some kind of a general law; yet none will argue that the drop in pressure explains the storm, because both events are caused by atmospheric conditions. An obverse of this is the example of the moon and the tides. Ancient mariners knew about the connection between the position and phases of the moon and the ebb and flow of the tides but did not construe this phenomenon in explanatory terms. Instead they saw it merely in terms of a correlation between the two, believing in all likelihood that God helpfully placed the moon in the heavens in order to guide them. It was only with Newton that people came to understand that it is the moon that governs and thus explains the rise and fall of the tides.

Another issue raised is that of the lack of temporal constraints. The reasoning used in the original treatment of explanation is time-independent. This creates the so-called asymmetry problem. In one of its classical formulations, it is presented as the explanation of an eclipse. Kepler's or Newton's law will allow us to deduce the time of a lunar eclipse from a given preceding point in the relative positions of the earth, the sun, and the moon. It could be said that the laws of celestial mechanics, in conjunction with the knowledge of some earlier positions of the planets, explain the phenomenon of the eclipse. Yet the same (time-invariant) laws of mechanics would allow one to deduce an eclipse "backwards," so to speak, that is from some later point in the relative positions of the sun, the moon, and the earth. Nevertheless, the proposition that this "backward" deduction can be legitimately counted as an explanation presents itself as highly problematic. From the same problematic league comes the flagpole example. A flagpole on a sunny day casts a shadow on the ground. The length of the shadow can be explained by deriving it, using the law of the rectilinear propagation of light, from the position of the sun in the sky and the height of the pole. However,

many would balk at stating that the reverse of this reasoning also constitutes an explanation, that is to say that the height of the flagpole is explained by the length of the shadow.

Yet another important objection that I would like to mention is that of irrelevance. The problem with the covering-law model is that it does not specify explanatory relevance conditions. Two typical counterexamples to Hempel's and Oppenheim's position are those of "hexed" salt and birth-control pills. In the first example, it could be suggested using the covering law's reasoning that a pinch of salt has successfully dissolved in water because someone, wearing a magician's hat, waved a wand over it and cast a magic spell. In the second example, it could likewise be claimed, following the same logic, that a man has not become pregnant because he has been regularly taking his wife's birth-control pills. Clearly, both claims are patently absurd, evincing that some important considerations are missing from the proposed covering-law schema.

The Causal Model of Explanation

The critics of the received view came up with a "rival" model that made an appeal to causes instead of general laws. Indeed, if the causal account is adopted in place of the covering-law account, it will solve the asymmetry and the accidental generalization problems. Causality instantiates the idea of temporal succession. To represent two physical events causally is to describe them in terms of a spatio-temporal contiguity. But this also requires the resurrection of the metaphysical notion of influence as that of causal force brought into existence by causal mechanisms. Switching the focus from law-like regularities to causal connections will show the inadequacy of the covering-law model in relation to the barometer example. The barometric reading and the storm do not enter into the relationship of causal dependency but merely of that of a correlation: the barometric reading is caused by the low atmospheric pressure, which, in turn, frequently accompanies the storm. Similarly, in the case of the flagpole, causal analysis will discriminate between the two symmetrical geometric derivations by demonstrating that the shadow is causally posterior to the flagpole and can thus be explained by it, while the opposite is not true.

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It would seem that attributing explanations to causes rather than to general laws would be an advantageous strategy because it would resolve some of the outstanding issues in the received account. At the same time, it too is not free from problems, which is the reason why the original thesis, in adhering to the empiricist tradition, appealed to laws rather than causes in the first place. For what are causes really? Being indebted to David Hume's view of causality as simply "constant conjunction" and his skepticism in regards to the metaphysical "reality" of causal connections, empirical reasoning aims to expurgate the remnants of theological ideas from sciences. An empiricist is committed to real phenomena and testable facts instead of unobservables and metaphysical constructions. This viewpoint is eloquently summed up by Bas van Fraassen in his book *The Scientific Image*:

To be an empiricist is to withhold belief in anything that goes beyond the actual, observable phenomena, and to recognize no objective modality in nature. To develop an empiricist account of science is to depict it as involving a search for truth only about the empirical world, about what is actual and observable. Since scientific activity is an enormously rich and complex cultural phenomenon, this account of science must be accompanied by auxiliary theories about scientific explanation, conceptual commitment, modal language, and much else. But it must involve throughout a resolute rejection of the demand for an explanation of the regularities in the observable course of nature, by means of truths concerning a reality beyond what is actual and observable, as a demand which plays no role in the scientific enterprise (TSI 202-203).

Even though the advocates of the causal approach have come up with some illuminating and original ways of resuscitating the idea of causal influence (see, for example, Wesley Salmon's "informational" conception of causal processes as processes that are capable of transmitting a mark in a spatio-temporally continuous way (SE 107-116)), causal theories still remain vulnerable to the charge of metaphysical thinking.

The explanatory model that understands the world in terms of causal interactions is termed the *ontic* conception of explanation, in contradistinction to the *epistemic* conception, which constructs knowledge on the strength of observation and inference. The strength of the ontic view inheres in its felt intuitive and commonsensical nature. After all, causal considerations are ubiquitous in our everyday reasoning, which is probably because causal explanations appeal to us and appear to wield superior explanatory power. Unlike Hempel's and Oppenheim's epistemic conception (the received view), which assumes a symmetry between descriptive and explanatory knowledge, the ontic conception makes a discrimination between the two and claims it as its strength. In the words of Wesley Salmon, "the realist can say that explanatory knowledge is knowledge of underlying mechanisms--causal or otherwise--that produce the phenomena we want to explain. To explain is to expose the internal workings, to lay bare the hidden mechanisms, to open the black boxes nature presents to us" (SE 134).

Inadequacies of the Causal Conception

In addition to its questionable epistemological status, the weakness of the causal model lies in its failure to handle probabilistic explanation in a satisfactory manner. Phenomena that are described by statistical rather than by deterministic laws are, of course, greatly prevalent in the world around us. In medicine and biology, we commonly deal with stochastic processes; and the odds of contracting a disease, developing a medical condition, or being cured by a prescribed course of treatment are all statistically calculated. Probabilistic models are also involved in the explanations of indeterministic or chance phenomena, such as the decay of carbon isotopes or the outcome of a throw of a coin. If one accepts the regularity-based conception of explanation, one has no philosophical qualms about explaining an occurrence by appealing to statistical laws. In everyday

life, one accepts as adequately explanatory a proposition that a patient's recovery is attributable to her having undergone a treatment by a highly effective drug. Neither is it problematic to explain a gambler's winning streak by claiming that his dice are loaded and that in loaded dice, sixes turn up more frequently. For a "causalist," however, these and other examples of events with probabilistic outcomes present a veritable conundrum, because no specific causal mechanism can be identified.

A weakness of the causal approach pertaining to individual cases is that singular explanations are sometimes nonexistent or inadequate. At this point, for instance, it is impossible to give an exact answer to the question of why this but not the other patient responded favorably to medication. Biology may or may not turn out to be genuinely indeterministic. We could, of course, nurse the hope that someday, with an increased state of medical knowledge, such an answer will be forthcoming. But this does not change the fact that there exist areas of irreducibly indeterministic character that causal reasoning will fail to illuminate. There could be simply no explanation as to why this particular radioactive isotope, and not its neighbor, decayed at this particular point, although we may have a ready explanation as to why a sample of radioactive material was reduced by a certain percentage after a certain number of days. Similarly, we may explain the percentage of electrons that tunnel through a barrier, but we could never explain why a given electron, as opposed to some other electron, tunneled through instead of being reflected. Philip Kitcher (SE 428-430) provides a vivid example of why looking for local as opposed to general explanatory accounts is sometimes not enough. His example concerns the reason why noble gases are chemically inert. The explanation involves the application of the Pauli exclusion principle to the atomic energy levels and the derivation of the idea of the electron shell-filling around the nucleus. One can demonstrate that in noble gases, the outermost shell is fully filled, which leads to the state of affairs whereby these chemical elements lack the opportunity to form ionic bonds. The explanation of why a certain noble gas cannot form compounds is thus made from a negative premise, using general reasoning. If we, on the other hand, were to trace a complete causal history of an argon atom in the presence of other elements, its history of chemical *inactivity* would tell us nothing of explanatory relevance.

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The Impasse

As we have seen so far, both the covering-law and causal paradigms are marred by serious flaws, even though each is illuminating in its own way. An ongoing argument concerns the philosophical primacy of each conception. Empiricists insist that the allegiance to laws must have precedence over that to causes, since our knowledge of regularities is based on observation and experiment. They suggest that our understanding of the world as an environment steered by causal mechanisms is not as incontrovertible as it might seem at the first glance. It is the other way around, as they see it: namely, it is our inherent understanding of the world that is ruled by lawful generalizations that makes for the *a posteriori* construction of causality. Onticists counter that causes provide powerful and intuitive criteria for the distinction between explanatory and

descriptive knowledge, and that the fact that causal representation makes use of nonobservables should not be seen as a problem, since many scientific descriptions also resort to unobservables (such as the atomic model). Salmon writes: "There is no *logical* necessity in the fact that causal mechanisms involve nonobservables; that is just the way our world happens to work" (SE 133). The view of causality as pre-eminent in human thinking is questioned by Kitcher, but backed up, on the other hand, by some cognitive science researchers. Kitcher believes that it is a mistake to "naturalize" causes: "Our everyday causal knowledge is gained by absorbing the lore of our community. . . [T]here passes into our common ways of thinking, and our common ways of talking, a view of the ordering of phenomena, and this picture of how phenomena are ordered is expressed, often though not invariably, in our recognition of causal dependencies" (SE 436). In claiming a derivative status for causality, he issues a challenge to the subscribers to the causal view: "If causal knowledge is observable knowledge, then the apparently implausible implications of that position should be addressed. But, if causal knowledge is inferential knowledge, then we are owed an account of the observational conditions on which causal justifications depend" (SE 460). (Something like the account that Kitcher requests is offered by George Lakoff and Mark Johnson in their book, *Philosophy in the Flesh*, where they contend that conceptualization belongs intimately to the phenomenon of embodied cognition. A repeatedly observed connection between our physical effort and its effect on the environment is externalized and projected onto the outside world and neurally imprinted as a causal mechanism--something to which I will return later).

The argument between the two rival conceptions of causes and laws is, to a large degree, an argument about understanding. Hempel, in *Aspects of Scientific Explanation*, writes that "to explain something to a person is to make it plain and intelligible to him, to make him understand it" (ASE 425). But what does it mean to "make someone understand something"? According to Salmon, "explanations enhance our understanding of the world. Our understanding of the world is increased (1) when we obtain knowledge of the hidden mechanisms, causal or other, that produce the phenomena we seek to explain, (2) when our knowledge of the world is so organized that we can comprehend what we know under a smaller number of assumptions than previously, and (3) when we supply missing bits of descriptive knowledge that answer why-questions and remove us from particular sorts of intellectual predicaments" (SE 135).

Some Later Attempts to Solve the Problems of the Two Models

Just what is implied by the idea of answering a why-question is elucidated by the linguistically-inspired pragmatic approach to explanation and one of its most prominent proponents, Bas van Fraassen. In the latter's view, it is not necessary to resort to the notion of causes, with all the epistemological problems that they invite, in order to resolve the problems with the received view. Van Fraassen makes a somewhat Piercean point about explanation, saying that it constitutes a triadic relationship:

The discussion of explanation went wrong at the very beginning when explanation was conceived of as a relationship like description: a relation between theory and fact. Really it

is a three term relation, between theory, fact, and context. No wonder that no single relation between theory and fact ever managed to fit more than a few examples (TSI 156).

His contention correspondingly is that when the missing context is supplied, both the relevance and asymmetry problems are automatically solved, because why-questions typically arise in very specific contexts. When we ask a why-question, what we mean is "why this as opposed to that, that or the other thing?", what van Fraassen calls "the contrast class," which implies relevant background knowledge. For instance, in the example of the baseball breaking the window, the contrast class would be "the baseball broke the window" vs. "the baseball bounced off," while our background information might include the possibility that the window is made of bullet-proof glass or that the baseball is manufactured of a very light, sponge-like material. In van Fraassen's view, if we are supplied with a properly developed "background theory" and have correctly defined the contrast class, we could easily rule out an invalid or irrelevant question (for example, in the case of the "hexed salt," the contrast proposition, namely that "the non-hexed salt sample did not dissolve" would obviously not be true). Thus van Fraassen implies that it is possible to maintain an empiricist position (that is to say, remain an agnostic with regard to the existence of nonobservables, such as causes) and at the same time, to escape the problems that beset the formalism of the received view by countering it with an alternative account of explanation, which uses pragmatic tools of interrogation (erotetic logic: that of thought processes whose conclusions are questions rather than assertions).

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One of van Fraassen's more memorable analyses is his rearticulation of the flagpole example that resolves the asymmetry problem. My own qualms with this example is its disturbingly question-begging character. Why would the questioning of the shadow length even arise? Without providing the circumstances, this question strikes me as purely formal and meaningless. One possible context that will imbue this demand for explanation with meaning would be to ask: "Why are the shadows so long? It must be later than I thought." Another possibility might even be: "Why are the shadows so long? We must be no longer on earth." Van Fraassen's own counterexample is quite clever and provides a meaningful context, such that the prompt to explain the length of the flagpole, given the length of the shadow (he replaces the flagpole with a tower) makes immediate sense. His is a story of a wealthy landowner, who murders his servant on the terrace of his house at 5 o'clock and later orders a tower built in such a location and of such a height that its shadow would cover the terrace at exactly 5 o'clock and spare the owner the unpleasant memories. Bas van Fraassen's pragmatic approach seems like a viable alternative to the covering law vs. the causal conception dilemma. But objections posed by its critics involve offering various examples that stymie its formal logic and allow for some patently absurd or invalid explanations. At the heart of the issue lie doubts about the possibility of creating adequate "background theory," which go back to the question of whether it is possible to codify our knowledge about the world. If knowledge, *i.e.*, pragmatic context, cannot on principle be formalized then the pragmatic theory of explanation is

vulnerable to the same class of criticism as the received view, with the latter's inability to provide formal criteria for "general laws."

Another interesting attempt to handle the problem of explanation through law-like regularities occurs in Nancy Cartwright's *The Dappled World*. Her main contention is that seeing the world of physical phenomena through the lens of covering laws is a mistake. Laws of nature as "necessary regular association[s] between properties" (TDW 49) are useful abstractions that are mistakenly universalized. They are useful in that they create working scientific models, but the models they allow work only on the "everything else being equal" (*ceteris paribus*) basis. That is to say they "hold only in circumscribed conditions or so long as no factors relevant to the effect besides those specified occur" (TDW 28), such as inside a battery, refrigerator, or a rocket--insofar as special shielding conditions are in effect. Under the circumstances when the protective cover is destroyed or cannot be constructed, general laws no longer obtain. Cartwright's example is the case of throwing a crumpled banknote out of the window. In this case, Newton's laws of mechanics and their application to falling bodies would be of almost no help in calculating the time it will take for the bill to hit the ground. One would have to take into consideration the action of the wind--a phenomenon so complex that it may never be successfully modeled.

Cartwright's name for the special circumstances in which law-like regularities hold *ceteris paribus* is a "nomological machine." As she visualizes it, a nomological machine is "a fixed (enough) arrangement of components, or factors, with stable (enough) capacities that in the right sort of stable (enough) environment will, with repeated operation, give rise to the kind of regular behavior that we represent in our scientific laws" (TDW 50). But if laws can no longer be seen as universal and governing all matter, but are instead restricted and dependent on nomological machines to recreate them, what then persists? It is difficult to shake off an intuition that Newton's laws are still in operation, if only partially, in the case of the crumpled note: it is just that other forces should also be taken into consideration for constructing the total force. Cartwright suggests instead to re-conceive physical objects in the physical world as endowed with "capacities," something not unlike Aristotelian *natures*: "to ascribe a behavior to the nature of a feature is to claim that that behavior is exportable beyond the strict confines of the *ceteris paribus* conditions, although usually only as a 'tendency' or 'trying'" (TDW 28-29).

Capacities, according to Cartwright, have philosophical primacy: they are the properties that set forth the principles for the construction of nomological machines in the first place. Thus, instead of proclaiming the universal validity of Newton's laws, it would be more accurate to say that masses always have a capacity to attract each other. Similarly, one could say that the Coulomb's principles account for the capacities of charged bodies to attract or repel each other. Capacities are always at work and have exact strength, which might be masked by other capacities that operate jointly with them. Importantly, however, capacities do not constitute "occurrent" or "measurable" properties in the empiricist's sense, such as positions, speeds, or masses of objects (it is not possible to measure "attraction" *per se*, after all)--they are abstractions. But they are indispensable abstractions, without which it would be impossible to get the nomological machine functioning. The

reason that capacities are "better" than causes is that by operating with the notion of capacities one could, from the empirical point of view, make justifiable truth claims. The reason, on the other hand, that capacities are "better" than regular associations encoded as laws is that (and here she makes an argument similar to the causalists') the universal law picture of the world is not good at distinguishing laws from accidental regularities, while with capacities, the problem of fake dependencies, such as those between the barometer and the storm, would not arise. As we can surmise from this, Cartwright advocates the view of scientific explanation that relies on capacities or neo-Aristotelian natures. It is an ontologically pluralist view, which does not seek to subsume laws under more general laws and eventually unify all regularities under one grand equation, but proposes diverse answers to why-questions in accordance to a script that runs something like this: "Why did such- and-such occurrence take place? Because it is in the nature of this type of object, endowed by such-and-such properties to effect this." Cartwright thus conceptualizes explanation by resorting neither to causes, on the one hand, nor to the empiricist fundamentalism of pure facticity, on the other.

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Last in this brief overview of scientific explanation, I will mention the explanatory pattern schemata of Philip Kitcher. Just as Nancy Cartwright's re-casting of the law-based view of the physical universe into the one that understands regularities as epiphenomenal, arising out of the successful operation of nomological machines, can be read as a way of fixing the problems with the Hempelian conception, Kitcher's idea of argument patterns could, in its turn, be understood as a further refinement of the causal conception in an attempt to articulate a causal account of statistical and emergent events. Instead of a history of causal propagation, Kitcher proposes constructing a schematic argument. He remarks that "[f]aced with explanation-seeking questions, the scientist is disposed to produce texts instantiating particular patterns" (TAS 82). These argument patterns, he contends, capture and schematize the way we understand theory. Kitcher invokes Thomas Kuhn's observation that "even in those instances where there are prominent statements that can be identified as the core of the theory, statements that are displayed in the texts and accompanied with names--as, for example, Maxwell's equations, Newton's laws, or Schrödinger's equations--it is all too common for students to know the statements and yet fail understand the theory, a failure signaled by their inability to do exercises at the end of the chapter. Scientific knowledge involves more than knowing the statements. . . [T]o know a theory involves the internalization of the argument pattern associated with it" (SE 437-438). Internalizing a schematic argument, according to Kitcher, means knowing how to "translate" a theoretical statement into a narrative line of reasoning and apply it to a specific situation (instantiate it). In this way, a schematic argument is rendered as a succession of schematic sentences. For example, a probabilistic moment in a statistical law, such as Mendel's law of genetics, could be articulated as a schematic sentence: "for any individual x and any alleles yz if x has yz then the probability that x will transmit y to any one of its offspring is $\frac{1}{2}$." (SE 439).

A strength of this approach is that it could be extrapolated to emergent phenomena and thus made

to accommodate genetic explanation. The narrative form of the schematic argument is particularly suitable for these types of explanation. Thus, Kitcher's application of this method to Darwinian selection entails encoding the emergent event of mutation as a schematic sentence of the type--"among organisms G there occurred a variation"--in the sequence of sentences that make up the narrative of how an advantageous property came to be selected. Another advantage of this representation is that explanations could be extended, which means that various narrative strands could be woven together. For example, the Mendelian narrative of inheritance could be included in the Darwinian narrative by way of detailing of what exactly is meant by the claim that a given property is heritable. The author believes explanation extension to be a strength, because it allows for a unification of theories without insisting, at the same time, on reducing all laws and explanatory accounts into one fundamental law. It is possible, says Kitcher, that "sciences may not be identifiable by concentrating on a few grand equations" (SE 447). Ultimately, what the argument pattern and causal conception have in common is that they both cater to the same intuition that wants an explanation to be narrative, that is to say, to recount it as a historical sequence of events that have led to the explanandum. But Kitcher's claim for the superiority of the schematic argument is that it avoids the weaknesses of the causal model, because it holds up in two important areas where the latter breaks down: 1) in being able to provide generalized accounts (such as explaining the formation of chemical bonds); and 2) in accounting for emergent and chance events.

The Psychological Undercurrent

In trying to identify the bone of contention between the two theories, it is hard to escape the conclusion that the divisive issue is the ambiguous status of explanation between that of a formal argument and a psychologically motivated act of justification. It would be simple, on the one hand, to just let go of the psychological aspect of what "feels" like an explanation, and concentrate on what one wants explanation to be or to do. This is what Hempel seems to be after when he insists, in his "Aspects of Scientific Explanation" article, on scientific explanation free from pragmatics, saying:

scientific research seeks to account for empirical phenomena by means of laws and theories which are objective in the sense of their empirical implications . . . ; and the explanations . . . based upon such laws and theories are meant to be objective in an analogous sense. This ideal intent suggests the problem of constructing a nonpragmatic concept of scientific explanation--a concept which is abstracted, as it were, from the pragmatic one, and which does not require relativization with respect to questioning individuals any more than does the concept of mathematical proof. It is this nonpragmatic conception of explanation which the covering-law models are meant to explicate (ASE 426).

But if one renounces all pragmatic considerations, resists all impulse to psychologize, and disavows all recourse to anthropomorphic thinking (exposed by Hempel and Oppenheim in the

case of functional and teleological explanations) what would remain of explanation proper? Or, to restate, how would what one is left with be different from straightforward scientific description geared toward prediction? The covering-law view does, in fact, claim a symmetry between explanation and prediction. But in this case, it would seem, the prompting question should correctly be a how-question, which does not discriminate between the two, because it could be read in both directions. Knowing "how" something works is also the projective knowledge, in Cartwright's terminology, of how to construct a nomological machine. "Why," in contradistinction to "how," contains a remainder, with respect to simple description. It is to this remainder that Hempel himself alludes in saying that explanation be made intelligible to the person who is asking.

8

The causal approach to explanation, on the other hand, exploits the expectation of intelligibility by demonstrating the inadequacy of the covering-law theory in handling asymmetries. The supporters of this approach remonstrate by insisting that we should look to our explanatory practices in order to locate the ground for explanatoriness. It is interesting that Salmon's objection to Hempel's dismissal of functional explanation in evolutionary biology turns the tables on the formal definition of explanation:

If an admissible explanation of any fact must be an argument to the effect that the fact-to-be-explained was to be expected by virtue of the explanatory facts, then functional 'explanations' are not admissible explanations. But I have often noticed that, in philosophy as well as other human endeavors, one person's counterexample is another's modus ponens. Hempel concludes from his discussion that functional analysis cannot qualify as an admissible type of explanation; at best, it has heuristic value. Others, myself included, would take the moral to be that, since functional explanations play a legitimate scientific role, explanations cannot always be arguments of the sorts endorsed by the received view (SE 31).

In other words, in Salmon's view, an argument should be legitimated as explanatory if it has been accepted as explanatory.

Conversely, if an argument cannot be accepted as explanatory, it is problematic to claim that in some formal sense it "is." Statistical explanations could be a case in point. The causal conception deems chance occurrences as simply inexplicable. The covering-law view asserts that there is "a statistical-probabilistic concept of 'because,' in contradistinction to a strictly deterministic one" (ASE 393), which has to do with expectations of favored odds, and on the strength of which we could accept explanations about such things as the efficacy of drugs or unusual winning streaks. But covering-law formulations of highly likely outcomes are valid from a bird's eye perspective and as long as they describe chance events collectively: "loaded dice tend to come up sixes," as Cartwright might express it. In situation, on the other hand, where the randomness of the outcome

is increased or events are individualized, justifying statistical explanations becomes considerably less acceptable. Hence, the less likely the event, the more shaky the explanation. Consider, for instance, the proposition: "it is in the nature of electrons to sometimes tunnel through a barrier and sometimes not." It is a measurably less satisfactory an explanation than the previous example.

Similarly, Kitcher's argument patterns do not, in the final account, solve the problem of unidentifiable causes. Kitcher himself provides the most telling example. Noting that statistical explanations of individual events are sometimes invoked in legal decisions of assigning responsibility, Kitcher presents a case for consideration--that of a widow who sues the government for the untimely demise of her husband. Her grounds for bringing up the case are the fact that her husband, who died of a rare form of cancer, spent his military service being exposed to atomic testing. It is known that the probability of a person with this kind of history contracting this type of cancer is 0.02 vis-à-vis the much lower probability of 0.0001 among the general population. Historically, in cases like these, lawyers for the federal government or private corporations have argued successfully that the positive determination of guilt cannot be made, because it cannot be decisively demonstrated that the husband's cancer was caused by his exposure to radioactivity in the army and not by some extraneous factors that may cause it in the population at large. Having earlier made a distinction between an ideal explanatory account that makes use of a deductive derivation and the best explanatory account that the phenomena will allow (such as that of an indeterministic event), Kitcher himself concedes that one cannot construct an ideal schematic argument but only one that allows for an incomplete answer to the question of why the husband contracted the disease. What it could answer at the most is that the man was at greater risk in contracting this cancer than a member of the general population. In a real-life situation, this weakened claim would not wield enough explanatory power to resolve the controversy definitively. Being structured somewhat like stories, Kitcher's argument patterns are presented by him as having the advantages of causal accounts as well as being able to deal with probabilistic occurrences. But I would object and say that for as long as this type of schematic argument is contestable in the court of law, Kitcher's model of explanation has not succeeded in explaining individual events. The link between explanation and responsibility proves, in my eyes, to be the crux of the whole issue of causality. The burden of legal proof places impossible pragmatic constraints on what is or is not an explanation.

Van Fraassen draws our attention to the fact that the psychological underpinnings of the issue put the philosopher of science in a real predicament regarding explanation's ambiguous status.

Many attempts were made to account for such 'explanatory power' purely in terms of those features and resources of a theory that make it informative (that is, allow it to give better descriptions ... But these attempts ran into seemingly insuperable difficulties. The conviction grew that explanatory power is something quite irreducible, a special feature differing in kind from empirical adequacy and strength. An inspection of examples defeats any attempt to identify the ability to explain with any complex of those more familiar and down-to-earth virtues that are used to evaluate the theory *quadescription*. Simultaneously, it

was argued that what science is really after is understanding, that this consists in being in a position to explain, hence what science is really after goes well beyond empirical adequacy and strength. Finally, since the theory's ability to explain provides a clear reason for accepting it, it was argued that explanatory power is evidence for the truth of the theory, special evidence that goes beyond any evidence we have for the theory's empirical adequacy (TSI 154).

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The type of reasoning above, however, comes dangerously close to professing old-fashioned essentialist thinking, as he points out.

Once you decide that explanation is something irreducible and special, the door is opened to elaboration by means of further concepts pertaining thereto, all equally irreducible and special. The premises of an explanation have to include lawlike statements; a statement is lawlike exactly if it implies some non-trivial counterfactual conditional statement; but it can do so only by asserting relationships of necessity in nature. Not all classes correspond to genuine properties; properties and propensities figure in explanation. Not everyone has joined this return to essentialism or neo-Aristotelian realism, but some eminent realists have publicly explored or advocated it (TSI 155).

Yet his own pragmatic approach falls short of providing a model of explanation that can adequately account for context and solve all pragmatic aspects. To take just one example, his theory would not be able to give a pragmatic answer based on formal logic to the question of why some (reasonable and unbiased) jury members would find compelling the argument corroborating the demand for compensation in the radiation exposure case, while other (reasonable and unbiased) jury members will not. It cannot be demonstrated to turn out merely a discrepancy in two competing but valid formalizations of context or the contrast class. The answer, I believe, lies outside of the province of the philosophy of science. To look for it, we need to contemplate the distinction between the how-question and the why-question.

Explanatory Agendas

Only occasionally do philosophers of science who produce theories of scientific explanation touch on the question of motivation. On the face of it, these considerations are extraneous to the project of explanatory theory as articulated in the philosophy of science. But the fact that the question of "why ask why?" is periodically brought up is, in itself, revelatory of its unacknowledged centrality to the fundamental assumptions in the authors' philosophical positions. Often the driving forces behind explanation that a philosopher explicitly lists are not the ones that drive his own argument. Several writers, for instance, have remarked that although Hempel insists throughout his essays on

banishing causal reasoning, causes are nonetheless periodically invoked, notably when his discussion seeks to illustrate formal logical propositions with specific examples. Hempel's ascription of motivation behind explanation, as we have already seen, are twofold: one practical and the other disinterested, pertaining to "man's intellectual curiosity" and his desire to understand himself and his world. (These familiar sentiments, glorifying the scientific enterprise by rehearsing stock-in-trade cultural clichés of scientific objectivity and inquisitiveness, are played up in a hilarious way in Salmon's discussion of angular momentum. Explaining how it is possible for a cat dropped from a substantial height to land on its feet, according to Salmon, is far from a trivial task. The problem is that the angular momentum has to be conserved, which means that a cat, dropped with a zero angular momentum and with its legs pointing upward is not supposed be able to turn its body around in the air. Could it be that the old saying, "a cat always lands on its feet," is false? In fact, no, Salmon contends. "Experiment has shown that the cat can twist its body in various ways while the net angular momentum remains zero to achieve the desired position upon landing" (SE 137). It is difficult, at this point, not to conjure up images of two scientists in white laboratory coats, one standing by a high-up window in a tall building with a cart full of cats next to him, casting them out one by one with their legs straight up, and the other at the foot of the building, checking their landing position).

Interestingly, toward the end of his article, Hempel gives a slightly different kind of an example about a man "who was puzzled to find that it got cold in his house whenever he happened to watch a television program in winter" (ASE 427). (The reason ended up being his TV's proximity to the thermostat, which made it so that the thermostat would get too warm and shut off). "Thus the quest for an explanation," offers Hempel, "is often a quest for the 'cause' of the puzzling occurrence" (ASE 427). Imagining the said man shivering in front of his television set imparts nuances of meaning to the word "puzzle" that exceed the disinterested sense of "intellectual curiosity." According to Salmon, as also discussed above, human need for explanation arises from the desire to understand hidden causes behind sensible phenomena, to reduce the number of independent bits of information that we possess, and to unify knowledge about local regularities under one overarching system. I cannot help detecting an underlying sense of anxiety that pervades these ostensibly intellectual exigencies.

We get a glimpse into the source of this anxiety from James Woodward's revealing comments on explanatory desiderata. One of the considerations that he mentions (which I have not seen taken up explicitly by other philosophers) is that we consider an explanation successful when it "diminish[es] one's sense of arbitrariness or contingency regarding the explanandum." Specifically, he continues: "an important feature of many explanations in statistical mechanics . . . is that they proceed by showing that for a great many sets of initial conditions, an outcome like the actual outcome would have ensued. In this way, one's sense that the actual outcome was fortuitous or arbitrary is at least partly removed" (SE 364).

This sense of arbitrariness, I would like to venture, is mitigated by law-like interactions between measurable properties that allow for exact deductive predictions in particular cases. At the same

time, it increases greatly when we deal with random events and is only partly assuaged with probabilistic laws that explain predictions on a statistical basis. But it reaches its peak when we focus on single, unpredictable situations spawned by emergence. This shift is reflected in Kitcher's schemata, which claim their strength by attempting to unify different explanatory circumstances; yet their individual instantiations reveal tension and variance in the structure of schematic sentences with respect to their degree of compression and codification. Schematic arguments for deductive laws are phrased instruction-fashion--they read like verbalized formulas (an example used above was: "for any individual x and any alleles yz if x has yz then the probability that x will transmit y to any one of its offspring is $\frac{1}{2}$ "). Statements that deal with emergent events, by contrast, sound more story-like and, just like stories, utilize the past tense ("Among the ancestors of G there was a group of contemporaneous organisms, G_0 such that..." (TAS 28)). The narrativity is toned down, however, by the fact that Kitcher blurs the distinction between the why- and how-question, applying a homogeneous explanatory framework to heterogeneous inquiries. When he asks "why do all members of the group G share the property P ?", his question can be understood in two ways. The first way to read it is, "show me how such state of affairs for all members is possible" or "show me how this came about." One could answer this simply by appealing to the Mendelian law of inheritance and to the fact that P has a selective advantage over the variant properties that preceded it. Note that this is a species of a statistical explanation where the concept of precedence is used formally (as it would be in an account of how a window got broken by a baseball). But in putting it like this, Kitcher already restates the traditional form in which evolutionary questions are asked, which is: "why does this particular group G have this particular property P (as opposed to some other conceivable property in its place)?" This is a different question, as I will proceed to show, and in answering a question like this, which deals with a singular event, temporality and the story-like character of the explanation acquire special significance.

10

The Breakdown of Functional and Genetic Explanations

The gradual loosening of explanation is indicative of the increasingly loose character of regularities to which it is applied. But when one is dealing with something that happens only once and cannot therefore be predicted, proceduralized, or controlled, one can no longer use a standard explanatory paradigm to elucidate this happening. Instead one turns to narrative genetic explanations, which address the specificity of the why-question, as pertains to emergent phenomena. Hempel considers them be "light" on "explanatory import," that is to say, on demonstrating the necessity of the explanandum in relation to known regularities or through an appeal to causal chains of events. Nonetheless they are allocated a visible role in scientific practice, especially in evolutionary biology, where they are often used interchangeably with a related class of functional explanations. Since functional explanations are encountered more commonly, I will start with them.

The word "function" is multivalent and ambiguous. While in its direct etymological sense, function signifies activity or performance, in the biological sciences, the term has acquired an additional

connotation of a "special activity proper to anything; the mode of action by which it fulfills its purpose" (OED)--a usage that is also invoked in descriptions of man-made devices or artifacts. Just as we say that "the function of a knife is to cut" or "the function of hands on a watch is to allow us to read time," the biologist would say that "the function of a jackrabbit's long ears is to assist thermoregulation." Other examples might be: "the function of the heart is to circulate blood throughout the organism" or "the function of protective coloration (mimicry) is to camouflage an animal to help it evade predators." Although such usage of *function* is both familiar and intuitive, it raises a suspicion that by simply transferring it from a mechanical to a biological description, we have illegitimately imported a sense of intentionality into our analysis of a biological organism. After all, "the knife has a function to cut" only because, guided by a final goal in mind, we have deliberately endowed this specific implement with this specific function. It is fair to ask whether such intentionality also figures implicitly in our understanding of biological functions? Do we impute to the heart the connotation of being manufactured when we say that "the function of the heart is to pump blood"? And does the act of manufacturing then imply an attendant purpose (things, after all, are designed and produced for a reason)? Does this phrasing, in other words, compel us to impose the framework of the Aristotelian final cause on biological entities? In other words, does ascribing a function to a biological entity entail endowing it with hidden teleology? Or as Elliot Sober puts it: "perhaps it involves an unacceptable anthropomorphism, a vestige of a bygone age in which living things were thought of as products of intelligent design" (PhB 84).

It is precisely this implication of hidden teleology that has led some philosophers of science, including Hempel and Oppenheim, to object to functional reasoning as anthropomorphic. They point out that couching this class of explanation in a seemingly non-teleological way as a claim that a given function confers an evolutionary advantage is deceptive. Saying that "such or such feature proved to be efficacious in enabling this species to survive" conceals a hidden teleology, because the law-like necessity of a certain characteristic to survival cannot be empirically demonstrated. This is the problem of so-called "functional equivalence"--the same function could be potentially conceived of as existing in a different (or better) execution. As Hempel and Oppenheim put it, "the fact that a given species of butterfly displays a particular kind of coloring cannot be inferred from--and therefore cannot be explained by means of--the statement that this type of coloring has the effect of protecting the butterflies from detection by pursuing birds, nor can the presence of red corpuscles in the human blood be inferred from the statement that those corpuscles have a specific function in assimilating oxygen and that this function is essential for the maintenance of life" (ASE 256). They conclude therefore that functional and teleological explanations lack real explanatory power. Yet if so, what has, one might ask, made them endure for so long? The authors venture that what has sustained this type of reasoning is its anthropomorphic character. Such explanations make psychological sense, because purpose is something we, as human beings, understand well. Functional explanations therefore falsely appeal to our "feeling of empathic familiarity" (ASE 257). Hempel dismisses this type of explanation on the grounds that the fact of a function's existence in its current form could not be inferred from the structural constitution of this function: one could theoretically envision a variety of design solutions to the same functional exigency; for that matter, a different design altogether that might even obviate the original functional need from the outset. As

Hempel puts it: "In sum then, the information typically provided by a functional analysis of an item *i* affords neither deductively or inductively adequate grounds for expecting *i* rather than one of its alternatives. The impression that a functional analysis does provide such grounds and thus explains the occurrence of *i*, is no doubt at least partly due to the benefit of hindsight: when we seek to explain an item *i*, we presumably know already that *i* has occurred" (ASE 313). The problem is that evolutionary accounts lack the ability to support counterfactuals, that is answer the what-if question, because they deal with singular events, yet the language and concept of explanation are based on counterfactual reasoning, illustrated by my own (inadvertent) use of teleological language just two sentences ago. It is tricky to escape a recourse to teleological phrasing, alluding to design, design features, etc., even if one does not subscribe to the idea that biological species were designed by a creator who had a specific purpose in mind in creating them.

11

I agree entirely with Hempel's assessment of the explanatory power of genetic explanations and find no fault in his reasoning. A number of detractors, however, take issue with his summary dismissal of functional-teleological reasoning, noting that certain selected traits and characteristics were, if not strictly determined, at least environmentally and biologically motivated. To go back to the jack-rabbit example, as already mentioned, the jack-rabbit uses its large ears in order to reduce its body heat. However, there are other known thermoregulating mechanisms, such as perspiration in humans and panting in dogs. Critics point out that in a hot, dry climate, the jack-rabbit's habitat, panting and perspiration would be unfeasible options of thermoregulation, because they would deplete the organism of water in a climate where water conservation is a priority. Some even say, given the stage of the evolution of the organism and environmental constraints, that the next step (of developing the feature in question) was virtually inevitable. The less committing version of this assertion (that the development of the thermoregulation mechanism of this general type is motivated by climate selection pressures) is unarguable, but does not have great explanatory power. Just because certain other kinds of mechanisms are precluded by some existent constraints does not mean that the design features we have today were shaped by evolutionary necessity. Neither need the functioning of a particular trait, such as the thermoregulating mechanism, be logically inferred from its evolutionary history. In principle, one could be of the "creationist" creed yet still be able to analyze correctly how the dilating of the blood vessels in the ears can expel extra heat and thus cool the organism. As for stating that the development of this feature was virtually inevitable--I find it conceptually unsustainable. Using this slippery-slope logic, we can trace the evolutionary development back in time in small increments and discover that the appearance of each emergent feature, by analogy, was "virtually inevitable." As a result, the whole origin and evolutionary path of a species could be demonstrated to be "virtually inevitable."

Another attempt to rehabilitate functional explanation has been made by evolutionary biologists who claim that the notion of a "natural" function can be meaningfully used in discussing biological adaptation without any unnecessary recourse to anthropomorphic thinking or metaphysical assumptions. The two main approaches to the understanding of functional explanation are

represented by the views of Larry Wright and Robert Cummings. For Wright, "the notion of an organ having a function--both in every day conversation and in biology--has no strong theological commitments" (CIEB 29-30). But it would not be in contradiction with scientific reasoning, which rejects conscious purposiveness, to impute to function a "weak" teleology that, by preserving the affinity between natural biological functions and the artificial functions of designed objects, would illuminate the meaning of functionality and legitimize its use in the biological sciences. It is possible, he believes, to arrive at a definition of a function that could be valid both for natural (biological) and designed (man-made) functions. Popular wisdom notwithstanding, such a definition, as he claims to demonstrate, would not involve the idea of "usefulness," in terms of which function is commonly thought. For artifacts, "usefulness" presupposes a purposeful design. The statement "the function of a watch's sweep second hand is in making seconds easier to read" is true even if its wearer is completely uninterested in this feature: something can be useful even if it is never used. The same cannot be said about a natural (biological) system. In addition, reading the statement "the function of the liver to secrete bile is useful to the organism" as an analogy to the first statement is highly problematic, because the system in which a natural function is useful (the organism itself) is not analogous to the one in which an artificial function is useful (not the object itself, but the interface between the object and the user). Wright thinks he has reclaimed function for legitimate use when he proceeds in the opposite direction and retraces the rationale behind the notion of usefulness to its viable and proper motivation. He suggests that what is essential to our sense of something being useful is "a teleological 'in order to,'" but that this teleology need not be swept under the rug because it instantiates a scientifically justifiable enterprise of investigating "how the thing with a function *got there*" (CIEB 37, 38). This line of questioning should be understood as asking for "the reason the organ is there by invoking natural selection." "If an organ has been naturally differentially selected for by virtue of something it does," Wright offers, "we can say that the reason the organ is there is that it does that something" (CIEB 40). This is, in other words, a better way of articulating the intuition behind the idea of "usefulness": the "usefulness" of a certain biological feature is ascertained by dint of the species' very survival. It would be perfectly valid, according to him, to say that "the heart beats because its beating pumps blood" or that "porcupines have quills because they protect them from predatory animals," as long as we understand the *because* conjunction in its specifically functional, as opposed to straightforwardly causal, sense. This means we are engaging a logic that in a folding-upon-itself move (or, as Wright puts it "convoluted forward orientation") tracks a causal sequence of events from the standpoint of known consequences (a theory of selected effects). Such a distinctive logic etiologically limited to "consequence-selection" criteria amounts to framing functional explanation in terms of an answer to the question of "What consequences does [this feature] have that account for its being there?" (CIEB 42). Or, "when we explain the presence or existence of X by appeal to a consequence Z, the overriding consideration is that Z must be or create conditions conducive to the survival or maintenance of X" (CIEB 43).

In short, what Wright claims to have presented is a definition of function that does not rely on the idea of conscious purpose and thus eliminates unacceptable theological connotations that the critics of functional thinking have imputed to it. He wants us to believe that his seemingly teleological "in order to" and his anthropomorphic "reason for a feature to exist" need not put us on

our guard, as long as we understand these turns of phrase in their etiologically warranted sense of how this feature became fixed. "Organismic mutations are paradigmatically accidental. . . But that only disqualifies an organ from functionhood for the first--or the first few--generations. If it survives by dint of its doing something, than that something becomes its function on this analysis" (CIEB 44).

12

What Wright's analysis is not prepared to demonstrate is what it means to say that something "survives by dint of" something else, because delving into that would raise questions about the importance of "survival" and its necessary preconditions, which are auxiliary to the general thrust of his articulation of functional explanation from the vantage point of a *fait accompli*. Instead of focusing on how a functional feature contributes to the organism's viability, which must entail an analysis of the contextual system and lead eventually down the path of "usefulness"--something that he wanted to escape in the first place--Wright satisfies himself with an acknowledgement of the fact of survival *per se*: an occurrence, which itself serves as a proof and illustration of functionality. However, by deliberately bracketing discussion of survival on a systemic level, his analysis becomes another version of genetic explanation. Indeed, the type of functional explanation that he advocates would both exceed a causal account and critically differ from it in accentuation. To give just one example, protective coloration of a species could be explained by recounting a chain of events that led to the camouflaged species gradually replacing the original, uncamouflaged variety. Such an explanation could be strictly causal, except where it accounts for instances of emergence, such as the evolution of protective coloration and perhaps, a sudden proliferation of predatory species (just as in a causal account of a baseball hitting a window, the fact of someone picking up a baseball and throwing it would qualify as an emergent happening). Once the information about initial conditions is known, the rest of the pieces fall logically into place, building up to an explanatory reasoning which argues that the new coloration helped the individual members elude predators and survive in greater numbers and inferring that the increased selection pressure contributed to the acceleration of this process until all members with non-adaptive coloring became extinct.

A causal account might also engage these elements. The difference is in the kind of prompt we are asked to answer, which offers a different focus of contemplation. From the point where we accept the fact of random mutation and the explosion of predator population as given, we are simply reconstructing a causal chain of occurrences that lead up to a change of phenotype. Essentially, such an explanation would differ little from the explanation of how a window got hit by a baseball, except in the statistical nature of the regularities to which it is appealing. Hypothetically, we could even re-enact the experiment if we could find a population of mixed coloring and confine it together with its predators within a relatively closed ecological system. However, there is a sense in which such a causal explanation does not really get at what drives Wright's quest of legitimizing the use of functional logic. The question that such an explanation addresses is rather "why" or even "how the original coloring disappeared." We could imagine that such a question could be prompted by

the bewilderment of finding oneself in a natural environment after a passage of time and becoming cognizant of a coloring change in a familiar species. A puzzlement of this sort could be adequately met by a chronicle of ecological change of the type just outlined. What such a chronicle would not fully answer is Wright's inquiry into "why a feature is there," in the teleological sense that he suggests (from the standpoint of consequence etiology with its convoluted temporal perspective). On the one hand, the question of "how a change occurred" is formulated from the position of a final outcome and asks only to unravel the causal sequence of events leading up to it. Information that is extracted in this way possesses minimal significance: it is a bare-bones description of what happened, on which no functional ascription, as it were, can be hung. The question that prompts for assigning a function, on the other hand, is a broader question, which, as Eliot Sober notes, asks us to entertain a hypothesis about origins (PB 86). Why origins? Because, put another way, it is a question that asks us to contemplate an original fortuitous event (mutation) from the standpoint of its outcome (survival), and, seen through the prism of this hindsight awareness, this contemplation becomes magnified with the sense of momentousness of the occasion. A functional description exceeds a causal description not in facts but in poignancy: it is no longer a chronicle, but a genetic explanation, a narrative, the first moment of which is imbued with the added significance of posterior knowledge. This posterior knowledge is corroborated by the knowledge that things appear, then cease to exist, and, moreover, some possible things never even come into existence. All of this is woven into a narrative of the vagaries of existence, a cautionary tale of extinction and survival with the moral of "such is life" or "thus it can happen." As such, the question that it poses and answers of "why something is there" is a metaphysical "why something exists." Such a question is unanswerable in scientific terms; it can only be approached as a matter of whim, an unfathomable act of discretion--a connotation already heard in Wright's insistence on contemplating selection but banning all consideration of selection criteria. Thus what exceeds causality in a functional explanation is an emphasis on content-free selection, framing it in terms very similar to Aristotle's efficient cause explanation, which looks to a (conscious) agent as the explanatory principle. What we then find is that Wright embarks on his enterprise aiming to "make sense of natural functions . . . independent of conscious purpose" (CIEB 30), but in offering an explanation structurally coextensive with efficient causation, Wright's etiological approach ends up presupposing consciousness even as he ostensibly denies it.

Another, but related, problem, pointed out by Sober, is that Wright does not provide us with criteria to find suitable candidates as functions. In critiquing his view of function, Sober cites a counterexample in C. Bourse (CIEB) regarding the incompleteness of the etiological model:

Bourse . . . describes a man who fails to exercise because he is obese. His obesity persists because he fails to exercise. Yet, it seems odd to say that the function of his obesity is to prevent exercise. This suggests that it is a mistake to equate function with explanations for why a trait is present (PB 87).

The reason Wright's definition breaks down here is because "how something got there" is not the

whole story. If a mountain chain "got there" because of earthquakes, we do not say that the function of earthquakes is to create mountains. Clearly, his line of questioning must have something to do with things sustaining themselves. But even this is not the whole story. An atmospheric condition may accidentally sustain itself through a chance confluence of events, but we do not talk of functions when we describe its contributing factors. By contrast, a biological feature must somehow be advantageous to survival in order to be explainable in functional terms. Obesity is not advantageous to survival, and so it sounds absurd to assign it a function. What Wright's analysis does not make explicit is that his theory of selected effects presupposes a teleology deemed by him as inappropriate in order to make a determination of what phenomenon or property can be subject to functional analysis. Meditation on evolutionary selection has to base itself on considering the consequences of a function vis-à-vis its contribution to the organism's viability, even though it might not explicitly acknowledge this. In other words, the consequence of a function has to in some way be *useful* for the organism--a demand that is consistent with the assumption of strong teleology Wright is at pains to eschew. His approach, from this perspective, relies on the very anthropomorphic understanding of purpose he sets out to banish in order to make itself intelligible.

13

A similar point is made by Richard Cummings, who argues that "if, as Wright maintains, there is a sense of 'because' in which the heart *is* there because it pumps blood and not because it produces heart sounds, then this sense of 'because' is as much in need of analysis as 'function.'" (CIEB 68). Cummings rules any assumption of teleology as unacceptable and starts from the opposite end, trying to clarify the specific content of "selected effects" rather than concentrate on their consequences, as Wright does. To do this, he attempts to derive a functional-ascription statement from the formal analysis of how a function contributes to the surrounding system. As a point of departure, he offers a popular functional definition that is used implicitly in many analyses and proceeds to demonstrate its inadequacy. Specifically, functionality is commonly understood "by identifying the function of something with just those effects which contribute to the maintenance of some special condition of, or the performance of some special activity of, some containing system" (CIEB 57). Here the term "function" draws on its previously mentioned sense of an activity "proper to something," where "proper" remains to be interpreted in an unproblematic way for biological systems. As already mentioned, Wright thinks that "proper" could be understood in the same way as it is for artifacts, namely, as an "action that fulfills a certain purpose." Cummings, who shows that this would lead to inadmissible consequences and wants to banish all connotation of purposefulness altogether, suggests instead Hempel's wording as a springboard: "the crucial feature of a containing system, contribution to which is to count as the functioning of a contained part, is that the system be maintained in 'adequate, or effective, or proper working order'" (CIEB 57). Thus "proper to something" becomes transformed into a "proper working order," which now stands in further need of clarification. As Cummings proceeds to analyze, Hempel's own gloss of this phrase as a kind of order in which the system "functions adequately" produces a circular definition. Indeed, to say that a function of something in a containing system is to contribute to this

system in such a special way so as to ensure that the system functions adequately begs the question about the function of the containing system. This, in turn, raises the necessity of an explanation on a higher level. "Either we are launched on a regress," writes Cummings, "or the analysis breaks down at some level for lack of function, or perhaps for lack of a plausible candidate for containing system" (CIEB 58).

At the same time, Cummings believes that this definition is on the right track in intuiting that a function-ascribing statement should be made by including the containing system in the analysis, not abstracting from it, as Wright does. His own attempt to cull out the germ of this insight and apply it so as to avoid the pitfalls of regress leads him to re-articulate functionality as a disposition (or a capacity). Thus he asserts that a function-ascribing statement is nothing other than a disposition statement--an observation of a behavioral propensity (saying that a heart functions as a pump in the circulatory system is the same as saying that it has a disposition to pump or that it is capable of pumping in this system). As for how we are to understand disposition formally, Cummings elaborates that to "attribute a disposition *d* to an object *a* is to assert that the behavior of *a* is subject to (exhibits or would exhibit) a certain law-like regularity" (CIEB 61). What is interesting about this view is that it comes very close to Cartwright's model of the nomological machine; and here we get a full implication of how such a conception would play out as an explanatory paradigm. Explaining a dispositional regularity, as Cummings maintains, amounts to explaining "how manifestations of the disposition are brought about given the requisite precipitating conditions" (CIEB 61). What this amounts to is an analytical strategy whereby the enveloping system is conceptualized as an assembly-line production that is broken down into a number of tasks. The entire assembly line corresponds to the enveloping system, while each task is analogous to an individual function, so that the capacity of the overall system to manufacture a product could be explained as a sum of the constituent capacities of its functional components. To re-cast this in Cartwright's terms, one could compare the line to a nomological machine--a sealed container holding a collection of parts that will give rise to regular behavior (geared toward churning out a finished product). Each sub-task could be imagined as a functional component--a nomological machine engaged in solving a particular difficulty by overcoming, as it were, an obstructing or resistant feature of the material environment. This mechanistic model could be applied unproblematically to biological systems, as Cummings believes. The circulatory, digestive, nervous systems--all of these possess certain capacities vis-à-vis the organism as a containing system. These, in turn, could be analyzed into smaller-scale capacities of the organs that make them up (heart, lungs, capillaries, etc.). As he remarks, biologists could easily and naturally visualize this as a representation not unlike "schematic diagrams of electrical engineering, with special symbols for pumps, pipes, filters, and so on" (CIEB 63). Such a representation lends itself to an explanatory strategy whereby one points to a capacity of a component against the background of the capacity of the containing system: for example, "the heart functions as a pump against the background of an analysis of the circulatory system's capacity to transport food, oxygen, wastes, and so on, which appeals to the fact that the heart is capable of pumping" (CIEB 64). What Cummings' model of functional explanation thus achieves is a contextual understanding of functionality, *i.e.*, that a functional claim can be made only by appealing to some larger capacity of the containing system.

Cummings' explanatory schema, however, is not problem-free, as it runs into the same difficulties as van Fraassen's pragmatic approach because of the lack of a viable "theory of context" that would be able to ground the starting point of functional analysis. His own example illustrates the predicament. He proposes that we consider the circulatory system from the point of view of the sound that it produces: "Each part of the mammalian circulatory system makes its own sound, and makes it continuously. These sounds combine to form the 'circulatory noise' characteristic of all mammals. . . The question is whether it allows us to say that the function of the heart is to produce a variously tempoed throbbing sound" (CIEB 65). He rejects this possibility as patently absurd and concludes that his model shall be restricted to non-trivial cases. This constraint, of course, begs the question of how "triviality" is to be determined, which points to his theory's major weakness. Namely, it should be kept in mind that Cummings' is a top-down analysis: we start from the system on the higher level and analyze it down to the low-level components. It does not present a problem to start with the level of the circulatory system and isolate the heart for functional analysis: phenomena such as circulation, respiration, digestion, locomotion, thermoregulation, etc., are well understood from the biological, chemical, or mechanical point of view (by analogy with other known physical phenomena). But what sets out these systems as significant? Why not, for instance, analyze the function of the human head as something that exists to wear a hat, against the background of the human body as a system that has a capacity for wearing clothes, to name an even more trivial example? In fact, Sober uses the-heart-as-noise-maker example to criticize Cummings' theory as "being too permissive in the function ascriptions that it endorses" (PB 87). This is because Cummings' analysis grounds itself implicitly in the teleology of survival that he has purportedly banished at the inception. The reason this remains hidden from sight is because his "non-trivial" examples of systems, such as circulation, are so familiar that the germaneness of sustaining life to their initial identification is no longer examined, and they are now perceived as self-evident units. But it is the criterion of "fitness" that "proper working order" resolves itself into on the level of the whole organism and that is passed down to make the level of the circulatory system meaningful as a unit of functional analysis. It is indeed impossible to make the initial functional determination according to the formal criteria that Cummings supplies us. He defines a function against the background of some capacity of the containing system and defines capacity as a behavior subject to a law-like regularity. But what would this law-like regularity be at the highest level--that of the organism? We could no longer identify it formally, based on some familiar mechanistic analogy, and so it would no longer make sense to appeal to laws. All we could do is resort to a holistic and teleological appraisal of the biological system having a "capacity for survival."

That teleology was implicit in this explanatory scheme from the outset is seen more starkly when we look at it from the nomological-machine angle. In such a representation, a pragmatic, goal-oriented aspect is a given. When we try to harness certain natural regularities, as Cartwright argues, we do so by capturing them within the shielded confines of a nomological machine, built to circumvent a hurdle that lies in the way of desirable behavior. If the physical world did not manifest

any resistance to our wishes, if it were possible just to snap our fingers to get what we want, there would be no need to construct nomological machines: the very idea of the nomological machine is predicated on imperfection and planning. In conceptualizing an organism as a "schematic diagram" of interconnected nomological machines, this goal-oriented character of our thinking is foregrounded with clarity (whereas the covering-law representation reveals, by contrast, the metaphysical assumption of the ordered Universe but not necessarily that of teleology). Just like Wright's, Cummings' attempt to rehabilitate functional explanation ultimately reveals circular reasoning. In his initial move, by equating functions with dispositions (which are nothing but dumb law-like regularities amenable to formal definition) Cummings clears functionality of all significance, but by glossing over the definition of (non-)triviality, he imports it back as an unexamined requirement for understanding something "against the background" of something else.

As I have shown, functional explanatory schemes start out by trying to justify the intuition that functional explanation constitutes a distinctive class of explanation valid for (biological) systems, but fall back on circular reasoning. The excess of meaning with which they extend causal description amounts to bringing in the consideration of survival, which, in turn, engages inadmissible presuppositions. It appears impossible to purge functional explanation both of genetic and teleological fallacies at the same time. If, like Larry Wright, one dwells on the question of selection but abstracts from the issue of fitness, one arrives at a version of the efficient cause explanation. Doing the opposite, on the other hand, like Robert Cummings, utilizes the logic of the final cause. In the latter case, functional ascription becomes a teleological claim about a viable design equivalent to a goal-ascribing statement. In the former case, functional explanation becomes interchangeable with genetic explanation, where history itself is endowed with extra meaning. But in both cases, the reflection on ends and origins would be "tacked," as a metaphysical mantle, onto a minimally significant causal analysis of the functional feature that could be competently made through a mechanistic analogy to known physical processes.

To shed some light on the tenacity with which functional and genetic explanations are defended as having a legitimate role, one should seize upon Wesley Salmon's *modus ponens* comment--if genetic explanations are accepted then they *must* be valid--and a very similar one by Larry Wright that other treatments of function "have overlooked, ignored, or at any rate failed to make one important observation: that functional ascriptions are--intrinsicly, if you will--explanatory" (CIEB 37). And indeed, we resort to functional and genetic explanations all the time. To explain any emergent happening, we tell a story that leads up to it, in which appeals to origins and goals are often combined. In his *Work on Myth*, Hans Blumenberg, for example, quotes Flaubert's diary entry from the latter's trip to Egypt in 1850:

during the day his group has climbed a mountain on the summit of which there was a great number of large round stones that almost resembled cannonballs. [Flaubert] was told that these had originally been melons, which God had turned into stones. The story is over, the narrator is evidently satisfied; but not the traveler, who has to ask for the reason why. Because it pleased God, is the answer, and the story goes no further. (WM 257)

Even though we cannot causally demonstrate the connection between the immediately preceding situation and the explanandum, we nonetheless find these stories satisfying. To understand in what way these explanations are acceptable, I recommend that we turn our attention to what exactly is being asked, or what, in van Fraassen's terminology, would constitute the contrast class for our question. Why ask "why"?

15

The Anthropological Content

The question of "why," as opposed to the question of "how," is brought forth, I believe, by the anxiety of having failed to take into account a certain fact. To dwell a little longer on the stones-as-melons story, the explanation in this case, as Blumenberg writes, aims to "naturalize" the unusual shape and size uniformity, which goes against the familiar experience of stones and is bound to raise consternation.

Melons just grow this way, and there is no need--in their case--for an explanation of why they look so similar and so uniform in size. Thus the introduction of the melons helps one to accept a characteristic of the surprising stones that stones do not in general and by their nature tend to have. It is a case of falling back on the life-world, on something that is familiar in it. . . (WM 257).

What the questioner is often asking is to be reassured that the world is as previously thought or that he has evaluated the situation correctly, and what he expects to hear is some fact that would reduce the new to the familiar. Take Hempel's example of a man who wonders why his teaspoon got dissolved in a glass of punch at a New Year's party. Is it disinterested curiosity that makes him wonder or an underlying anxiety that all is not as he thought or as it should be with the world? Is punch such a substance that it can dissolve spoons? Are spoons made of such a substance that they can melt in liquid? I would imagine that information about metals, such as Wood's alloy, that are capable of melting at the temperature of hot punch and about the spoon being a party joke made of such an alloy would be received by him with some small amount of relief and not just register as an intellectually satisfactory explanation. If we recognize this anxiety, we will solve many a contextual problem. The classical flagpole asymmetry problem would not arise if we ask: "why question the length of the shadow in the first place?" As I indicated earlier, it is an odd why-question to ask at all. It could be so that, given the height of the flagpole and the position of the sun, there is a marked discrepancy between the actual length of the shadow and the one we would expect based on earlier experience. What we would really be asking then (anxiously) is "could it be later than I thought?" or "am I in some alternative Universe?". To sum up, the contrastive sets of questions in these cases would not be, as van Fraassen would have them, or , but --considerations whose pragmatic import for van Fraassen might be buried in "background theory," but which, I

believe, must take the center stage if we are to understand the specificity of the why-question.

But even the "is all as it should be with the world?" question is derivative with respect to the "why something exists" question. Let us think back to the questions "why does the jack-rabbit have big ears?" or "why does the giraffe have a long neck?" What do they invite us to ponder that remains outside the scope of functional analysis? What is "behind," as it were, the causal determination of how these features became fixed, is a sense of wonderment at the variety of life, its whimsical nature, its sheer arbitrariness, tinged with, as I suggested above, anxiety over the precarious and vulnerable status of existence per se. The "why" one is asking could be a way of saying: "Look, here are some long and pointy ears that really stand out compared to other ears we see around us. And look at this neck. It is so much longer than all the other animals' necks." Or it could be: "I wonder what ill fate befell the small-eared rabbits and the short-necked giraffes that I saw here earlier." It could be understood as a question about emergence, difference, a question of whether the world is big enough to accommodate aberration. And even this question could be secondary to just saying: "look"-- an utterance whose obscure status originates at the vanishing point of grammatical mood, where we can no longer distinguish between asking a question, lodging a supplication, or issuing a prompt. What inspires awe at this moment is our contemplation of the facticity of being.

It is this family of questions, summed up by Martin Heidegger as "why are there beings at all instead of nothing?" which he called the fundamental question of metaphysics, assigning to it the status of the first of all questions. *Why*, I would like to claim, is a question of metaphysical anxiety *par excellence*, which ties into our understanding of existence as fraught with realizable or unrealizable potentialities, as Heidegger shrewdly understands the contrastive phrase "instead of nothing" to signify. When the prospect of nothing is injected, all beings "come to waver within the broadest and harshest possibility of oscillation--the 'either beings--or nothing,'" and such a wavering "opens [human existence] up to possibilities not yet asked about, futures to come, and thereby also binds it back to its inception that has been" (IM 31, 47). But this would precisely be the structure of genetic explanation, as elaborated by Larry Wright. Genetic argumentation, I believe, provides us with the most general paradigm for the why-question that can afford us important insights into what constitutes the "explanatoriness" of explanation.

This is also the province of the earliest narratives: myths, legends, fairy tales. In fact, many fairy tales have a structure not unlike explanations in evolutionary biology, with titles like *How the Elephant Got His Trunk* or *Why the Jellyfish Has No Bones*. Hagiographies and biographies, without unduly stretching the point, can be viewed as explanations of greatness. Even many novelistic narratives can function as explanations of some thematic point. In his *Work on Myth*, Hans Blumenberg grounds mythological narratives anthropologically (but his analysis would work equally well for other types of narratives) as a desire of humans to understand themselves as free from the constraints of what he calls the "absolutism of reality"-- a phrase denoting man's lack of control over the outside world, which is experienced by him as an environment hostile and impervious to his needs and resistant to his exertions to transform it. This desire is born in the

defensive reaction of an early hominid who has left its native environment in the rainforest for the savanna and now faces the challenge of meeting his food needs in an ecological niche for which he lacks adaptation. According to Blumenberg, the exigencies of the absolutism of reality are eventually met by *theory* as "the better adapted mode of mastering the episodic *tremenda* of recurring world events" (WM 26). Theory, as he points out, domesticates the world, easing its "episodicity" by regularizing knowledge and introducing ordered practices and iterative procedures. But some of this episodicity will always retain a random, haphazard character, will forever be irreducible to law-like regularities, will fall outside the realm of what could be theoretically ascertained. And the mythological narrative will be there to deal with unrepeatable, emergent events. What I am suggesting, however, is not that mythological narratives offer proper explanatory responses to existential why-questions about emergence--questions, which, in their turn, have an originary status--but rather that why-questions are anthropologically coextensive with narratives. Therefore the ultimate "why" as well as its local instantiations can never be answered. The why-question itself is embedded in the structure of narrative; or to put it another way: it is "because" we have language, "because" we have narrative, that we ask "why."

16

If one extends some of the ideas about embodied cognition expounded in cognitive science today, one could speculate that narrative structures resonate with our physical alienation from the world. In *Philosophy in the Flesh*, George Lakoff and Mark Johnson contend that our conceptualization of the surrounding world as endowed with causal relations is fundamentally *embodied*, meaning that our conceptual system is "neurally" grounded in our sensorimotor experiences. An important implication of this is that logical and rational inference are instances of sensorimotor inference. The way this works is through an observed connection between an experienced exertion and its effect on the world. From this experience of "felt" conjunction between willed movement and its imprint on the surroundings, an extrapolation is made to all other conjunctions between environmental disturbances, which is eventually conceptualized as a cause-effect association--a precondition for narrative. Mark Turner goes further in his book, *The Literary Mind*, arguing that storytelling is a fundamental human activity, with stories, as "complex dynamic integrations of objects, actors, and events" (10), rather than individual objects or concepts, being cognitive "primitives" that reflect a unit of thought. Such basic narrative structure also lends itself inherently to explanation: because it is natural for us to think in narratives, we are used to retracing stories back to their inception.

When a drop of water falls mysteriously from the ceiling and lands at our feet, we try to imagine a story that begins from a normal situation and ends with the mysterious situation. The story is the explanation. The narrative imagining is our fundamental cognitive instrument for explanation (LM 20).

Unfortunately, Turner does not take the idea of narrative explanation any further. But he draws connections between narrative and language, saying that an elemental spatial and sequential

story, called an image schema (like leaving the house, sitting on a chair, throwing an object) has the same conceptual structure as the basic grammatical clause: "The abstract narrative structure is projected to create the abstract grammatical structure" (LM 143). Just as a rudimentary abstract story chronicles an agent performing an action, a sentence runs from the subject to the predicate. But a grammatical sequence records something else: the immediate embodied movement of the image schema may get extended by an action-at-a-distance encoded in the structures of the direct and indirect object, marking the transition from the immediate to the remote ("he threw a spear at an animal").

Language maps the world of material culture that is no longer embodied. Things suddenly come into our view and just as suddenly disappear. We can manipulate them prosthetically with the help of hand-held tools and thrown projectiles, but can only make the tools extensions of our physical bodies in an ever-diminishing sense, as they continue to become more removed from our bodies, more virtual. Representation, a crucial anthropological mark of human culture, reflects this separation anxiety. This anxiety, I believe, permeates and underpins both what Blumenberg sees as the human striving to overcome the "absolutism of reality" as well as what Eric Gans identifies as the paradoxical impasse of the triangular mimetic configuration (SP 18-23). But it would be equally correct to say that the separation anxiety itself is epiphenomenal to representation. The point here is not to assign epistemological primacy, to provide, as it were, an explanation of explanation, because we are mining a territory that is "beyond" the notions of causality or succession. What I see rather as an anthropological project of interest is tapping into the connections between explanatory exigencies and narrative representational structures.

One such possibility is sketched out by Heidegger, whose existential and avowedly anti-anthropological project yields nonetheless profound anthropological insights. I would like to draw on his analysis of the existential structure of significance, as expounded in *Being and Time*. Traditionally, understanding is related to the process of inscribing a concept into and later retrieving it from the symbolic network of meaning. That is to say, knowing where and how a concept fits into the hierarchical structure of categories and the grammatical system, as well as being able to engage figurative associations and garner relevant bits of pragmatic contextual knowledge are all indispensable to the act of understanding the meaning of a concept. Heidegger, however, adds a "human" parameter to this schema. Signs for him are not subject to formal definition--they are "handy" or "useful things" that help us orient ourselves within the referential totality of signifying relations. These signifying relations construct a meaningful context for our need-driven, embodied, situated, and goal-oriented understanding. This means that the world is pre-understood by us not as a kind of "background theory" but as a sum total of human imperatives--both daily strategies of going-about-one's-business as well as self-reflexive questions about the meaning of one's life. It is against the backdrop of embodied exigencies that human understanding can grasp and thematize something as significant.

Significance for Heidegger is constituted not by the directionality of attention, but by a structure of relevant relationships. (Indeed, we can turn our attention to something only to discover that it is not

significant). Heidegger arrives at this by treating understanding as something that is always *attuned* (an example of attunement would be the sense of anxiety with which why-questions are tinged), and pointing out that this attunement is rooted in understanding's *thrown possibility*. The idea of *throwness* is related by him to facticity, the fact of finding ourselves existing in the already existing world (and the existential predicament it engenders). The awareness of *possibilities* pertains to our "projective" thinking that pre-understands itself as situated and goal-oriented and is therefore perpetually in the process of planning ahead and making conjectures about potential futures. Significance is identified by Heidegger with this structure of thrown projection and is said to be constituted by two determinants that he terms *upon-which* and *for-the-sake-of-which*--the original relations of relevance which ground our understanding. Meaning thus is anchored both in the past (as something that finds itself simply thrown into the world) and the future (as something that looks ahead to what it could potentially be in order to understand what it is), and we have access to it in a temporal act of understanding called the *Moment*, whereby we "retrieve" future possibilities by mapping the past upon the future.

17

Unlike categorical and grammatical structures, which are atemporal, the structure of thrown projection both thematizes time and unfolds in time, and the temporal actuation of this structure can be read narratively. Thus, what I am suggesting is that Heidegger's basic unit of meaning is narrative, although it is important to note that it reveals a different understanding of narrativity than in Turner, where a story is understood simply as a sequential action. Heidegger's human-scale narrative, on the other hand, resonates with affect, wherein the *Moment* crystallizes an act of awed reflection on the facticity of existence, its momentous occasions, and lost opportunities. The pathos of this reflection is of the same variety that animates functional explanation: its *Moment* is topologically similar to the vantage point of the post-factum appreciation of survival from which the functional why-question is asked; at the same time, its attunement to the future is comparable to the teleology of functional "in-order-to" purposiveness. Heidegger gives us a particularly apt model for analyzing the logic of consequence-selection. The tension between its two polar determinants of "upon-which" and "for-the-sake-of-which" produces an explanatory movement of "convoluted forward orientation" that is characteristic of the etiological "because." In other words, the problematic of explanation is inscribed in Heidegger's analysis of significance, which clarifies the teleological and genetic aspects of narrative as explanation, demonstrating how the "upon-which" is transfigured into the Aristotelian effective cause and the "for-the-sake-of-which," correspondingly, into the final cause.

Such a perspective on narrativity can be put into dialogue with generative anthropology's narrative theory. It may be argued that the structure of significance, which is content-free in Heidegger, could be particularized as mimetically-driven. In *The End of Culture*, Eric Gans gives an analysis of narrative as a cultural adaptation for sublimating resentment: "The resentful imagination is a reaction against real perceptions that are painful in that they show another in the place that the self would like to occupy" (EC 225). Instead, mimetic desire, which originally intends the real, gets

redirected toward the imaginary and propitiated by a satisfactory fictional resolution. Hence "[t]he esthetic offers an internal solution to resentment" by instantiating a movement of its deferral (OT 125). The Heideggerian schema can accommodate the mimetic scenario of deferral by constructing a representational framework within which the subject can articulate an explanatory narrative of imaginary fulfillment. But its emphasis is shifted to explanation, which marks the subject's understanding of his own predicament as significant. The "upon-which" and "for-the-sake-of-which" of significance function as the system of coordinates that define his current position on the resenting periphery and his aspiration to occupy the central position, creating a narrative vector along which a story of mimetic satisfaction could be temporalized. Because his model is explanatory, it allows for a mimetic reading of a literary narrative in two ways: firstly, as an imaginary identification with its protagonist and a sublimation of unfulfilled desires, and secondly, as the production of a personal narrative of emancipation that patterns itself on a fictional one.

Another point of contact between the argument presented here and generative anthropology is the question of the epistemological and methodological role of explanation in the humanities. As I show, the pursuit of explanatoriness can be pushed only so far. As we get to descriptions of emergent events, we also exhaust the logic of explanatory thinking, evinced by how various philosophical accounts resort at this point to the claim of intuitive self-evidence. This suggests to me that we should approach explanation theory as the watershed issue between the humanities and other disciplines. The fault line between the two types of discourses runs, I believe, along the narrative schema of generative explanation--a story that tells us not only about things we want to know but just as much about ourselves. I propose that we take this circumstance as a point of departure. The implication that I draw from my claim that explanation is coeval and coextensive with representational structures is to approach explanations in the humanities from two perspectives. On the one hand, we can treat them as productive accounts of cultural histories after the fashion of generative anthropology. Gans defines his project by saying that: "The reconstruction of the originary event provides a minimal configuration within which all essential human categories may be situated" (SP 6). This is a view, of course, that is predicated on the mimetic as the founding category. As he sees it: "humanity is the species for which the central problem of survival is posed by the relations within the species itself rather than those with the external world" (OT 2). If one sides with Blumenberg regarding the importance of physical survival and traces the origin of symbolic forms to the crisis of man's loss of biological niche, one might instead look for significant milestones in the cultural history of overcoming the "absolutism of reality" (the way Blumenberg does in tracing the transformation of myths). On the other hand, however, we can put under scrutiny the very anthropological imperatives that give rise to explanatory histories. From the perspective of generative anthropology, I would like to suggest that such a narrative itself institutes the ritualistic reenactment of the birth of representation and the originary experience of significance.

I have argued that representation and, in particular, narrative give rise to the explanatory problematic. In the sciences, the search for explanation is the engine that drives the scientific enterprise. The illuminations that it affords allow for predictive knowledge and yield insights into

necessary connections and regularities--as well as their practical outgrowth in the form of rockets, vacuum-cleaners, and other nomological machines. But given that explanatory activity in the humanities is essentially circular, can we, under these circumstances, talk about the progress of human knowledge, and if so, how do we define it? If humanistic knowledge illuminates--and I believe it does--what kinds of insights does it generate, what investigative methods does it avail itself of, what practical applications does it give rise to?

18

I will leave these fundamental questions largely unanswered except to offer one final reflection. I have suggested above that the question of "why?" falls under the rubric of humanistic knowledge. I would like to suggest further that the more fundamental question that it leads to (and that humanistic knowledge seeks ways of answering) is the question of "what-to-do?" The idea of free choice arises and becomes thematized with representation, together with the need for decision-making criteria. Making an informed choice is unproblematic in the areas of proceduralized knowledge, that is to say, when our mode of knowing becomes theoretical. But for the plurality of cases that cannot be attributed to law-like regularities or subsumed under nomological machines, the rationale behind the decision-making process must either be bolstered by the authority of dogma or work itself out "parabolically" by seeking legitimacy through modeling itself on culturally-sanctioned "master"-narratives. The latter strategy, I believe, captures one important way in which humanistic knowledge increases.

Literary interpretation and literary and cultural theory are engaged in an open-ended discursive practice, casting and re-casting narratives in terms of other narratives, as opposed to scientific discourse geared toward reaching a consensus over a finished model. I would like to view this open-endedness as humanistic discourse's methodological specificity: neither a weakness, a sign of disciplinary "softness," nor a strength, a tolerance of a diversity of opinion, because both attitudes presuppose a goal-oriented critical performance with an eye toward theory-building. Instead I propose to regard humanistic activities as a praxis that opens up rather than theories that close off. What they repeatedly reopen is our *attuned* striving to understand ourselves as free, and what this opening-up elucidates is the emergence of explanation as an exercise of our freedom to re-invent ourselves. This is why predictive assessments entailed by traditional explanatory accounts seem untenable in the context of humanities. What this might point to is a philosophical anthropology that, among other things, seeks not to explain explanation but humanize it, uncover the unfolding of its various imperatives and ferret hidden agendas out of narrative practices.

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Working Bibliography

Blumenberg, Hans. *Work on Myth*. Cambridge, Massachusetts, and London, England: The MIT Press, 1985.

Cartwright, Nancy. *The Dappled World: A Study of the Boundaries of Science*. Cambridge University Press, 1999.

Curd, Martin, Cover, J. A. *Philosophy of Science: The Central Issues*. New York, London: W. W. Norton & Company, 1998.

Gans, Eric. *Originary Thinking: Elements of Generative Anthropology*. Stanford, California: Stanford University Press, 1993.

----- . *Signs of Paradox: Irony, Resentment, and Other Mimetic Structures*. Stanford, California: Stanford University Press, 1997.

----- . *The End of Culture: Toward a Generative Anthropology*. Berkeley, Los Angeles, London: University of California Press, 1985.

Heidegger, Martin. *Being and Time*. State University of New York Press, 1996.

----- . *Introduction to Metaphysics*. New Haven & London: Yale University Press, 2000.

Hempel, Carl G. *Aspects of Scientific Explanation (And Other Essays In the Philosophy of Science)*. New York: The Free Press, London: Collier-MacMillan Limited, 1965.

Kitcher, Philip, Salmon, Wesley, ed. *Scientific Explanation: Minnesota Studies in the Philosophy of Science*. Minneapolis: University of Minnesota Press, 1989.

----- . *The Advancement of Science: Science Without Legend, Objectivity Without Illusions*. New York, Oxford: Oxford University Press, 1993.

Lakoff, George, Johnson, Mark. *Philosophy in the flesh : the Embodied Mind and its Challenge to Western Thought*. New York : Basic Books, 1999.

Sober, Eliot ed. *Conceptual Issues in Evolutionary Biology*. Cambridge, Massachusetts, London, England: The MIT Press, 1994.

Sober, Eliot. *Philosophy of Biology (Second Edition)*. University of Wisconsin-Madison, 2000.

Turner, Mark. *The Literary Mind: The Origins of Thought and Language*. New York, Oxford: Oxford University Press, 1996.

Van Fraassen, Bas C. *The scientific image*. New York : Oxford University Press, 1980.

Abbreviations

ASE --*Aspects of Scientific Explanation*

CIEB--*Conceptual Issues in Evolutionary Biology*

EC --*The End of Culture*

IM --*Introduction to Metaphysics*

LM --*The Literary Mind*

PB --*Philosophy of Biology*

PS --*Philosophy of Science*

OT --*Originary Thinking*

SE --*Scientific Explanation*

SP --*Signs of Paradox*

TAS --*The Advancement of Science*

TDS --*The Dappled World*

TSI --*The Scientific Image*

WM --*Work on Myth*