

# Teleological, Causal and Evolutionary Explanation

## Introduction

The goal for which one performs an action explains it. Or does it? In a deterministic world, must not everything be explained causally? Consider the following argument:

1. Every event has a cause.
2. Human actions are events.
3. So all human actions have causes.
4. If an event is caused, it is unfree.
5. So all human actions are unfree.

I reject this argument. I am a compatibilist: I accept the scientific worldview that everything can be explained by natural, causal laws, but I believe that human actions (and biological functions) can still be explained teleologically, by their ends – a precondition for freedom. This paper is one of a series of attempts to show how such compatibilism is possible, this time by focusing on the nature of explanation.

I will proceed by analyzing three modes of explanation in turn: Causal, teleological, and evolutionary. I will conclude by arguing that Absolutism and Reductionism – anti-compatibilist positions – are wrong.

## I The Nature of Explanation

Explaining is a human activity. We ask for an explanation when there is something we do not understand. Explaining reduces our puzzlement. Yet not all true accounts explain.

- Why did the needle on my thermometer rise?
- Because the room temperature increased.

But I knew *that* already; if that is not what was puzzling me, this answer has no explanatory value for me.

- Because air molecule number #1 imparted x ergs of kinetic energy to molecule #20 of the metal strip in the thermometer, and molecule #2 imparted y ergs of kinetic energy to molecule #21 of the metal strip, and molecule #3 imparted z ergs of kinetic energy to molecule #22 of the metal strip ...

This account, even if we had the centuries necessary to hear it out, would increase puzzlement rather than reduce it.

- Because the needle is connected to a metal strip that expands when heated.

Ah! Now I see!

An explanation successfully explains only when it appropriately addresses what is puzzling the inquirer. Explaining is therefore an essentially contextual activity that depends on the current knowledge and interests of the parties involved. As Larry Wright puts it:

'Why?' questions do indeed derive much of their sense from contrasts implicit in the context of inquiry; the perplexity being expressed is very often not clear until we understand something about what the person asking the question expected in the circumstance.

(Wright 102)

- Why did the billiard ball fall into the pocket?

- Because the cue ball hit it at the right angle and speed.

Good! I was afraid that someone had cheated by tilting the table. If you had offered a response that included a detailed account of the electromagnetic interactions of the molecules in the billiard balls, I would have read it as obfuscation. That would have increased rather than decreased my fear of cheating.

But, says an objector, the *real* explanation is the molecular one. Actually, even molecular interactions need to be accounted for by quantum mechanics, or maybe string theory, if we are to have the *real* explanation. Even then, it would not be the real explanation until we include a complete account of the properties of the table, the room, the gravitational influence of the stars, and indeed the quantum state of every particle in the universe.

This demand for an absolute explanation is mistaken on a number of counts. First, it sets an unachievable standard. More importantly, it misses the fact that explaining makes sense only within a context. For whom would such an absolute account reduce puzzlement? For God? But God is not in the business of explanation; since, according to the Hellenistic-Christian tradition, she has no imperfections and so could never be perplexed in the first place. Explaining is a human activity and decontextualizing it, as an Absolutist does, results in absurdity. The notion of explainability-in-itself is forlorn. All explanation is for someone (or perhaps for a community) with a set of concepts and prior knowledge, and, in particular, a specific confusion.

What is the monetary value of the Canadian dollar? To the Americans it is US\$0.99. To the Europeans it is €0.75 (except, of course, to the British who think it is worth £0.50). But apart from these relativistic opinions, what is the Canadian dollar *really* worth? Do you mean, what is it worth from God's point of view? But God is not into exchange. There is no such thing as monetary value in itself. Money has value only in the context of exchange systems. This is the mistake of the Absolutist.

Newton made this kind of mistake. We can ask, what is my speed relative to the ship? What is the speed of the ship relative to the earth? What is the speed of the earth relative to our galaxy? But Newton also thought that we could ask what is the absolute speed, that is, the speed as it would be to God. ("Space and time are God's sensorium," he said.) Einstein corrected the error: all speed is contextual; it is relative to a non-absolute, spatio-temporal observer.

Newton's error concerned space; the Absolutist's error concerns explanation. The basis of the error, however, is similar: it is to take an essentially contextual entity -- speed, monetary value, explanation -- and project it into some metaphysical isolation where it no longer makes sense.

The examples of explanatory context which I have given so far are primarily practical ones, but theoretical explanations are no less contextual. A medical researcher investigating whether a disease is genetic or due to infection is puzzled about the relationship of the disease to genes or bacteria; quantum mechanical accounts of the phenomena will fail to resolve her puzzlement. Questions must be answered at the appropriate level if the explanation is to be successful.

One way that an Absolutist might attempt to escape the contextual nature of explanation is by declaring that *real* explanations are *complete* ones. The superintendent asks, "What caused the van accident?" If the traffic investigator is an Absolutist, he will start talking not only about black ice on the road, but also about all-season tires, the camber of the road, the visibility, the alertness of the driver, the

accident-prone nature of vans, the width of the road and so on, indefinitely. But each of these factors themselves have to be accounted for. The tires were all-season because that is what the mechanic installed; she installed them because of school-board funding restrictions; and these in turn were due to the government budget, which was based upon bond-rating agencies in New York, who were responding to corporate pressure for profits due to the nature of the capitalist system, which came into being in the 18th century due to changes in the means of production, etc. etc. etc. The causal chain goes back to the Big Bang. Do not be surprised if the superintendent fires such a traffic investigator on the grounds that he has failed to do his job, namely, explain the accident. It is not that what the investigator says is incorrect. An explanation could fail for one of two reasons: the explanation might be wrong; or it could be the wrong explanation. The Absolutist mistakenly believes that an explanation is not a real explanation until it is complete, until all the causal factors, and all the causal chains which led to these factors, have been accounted for -- an impossible task. An explanation may be perfectly adequate, though incomplete, if it appropriately responds to the perplexity generated in the context.

An Absolutist, who is uncomfortable with the contextual nature of explanation, may try to escape this conclusion by claiming that the universe is a complex, perhaps deterministic, whole and so an explanation is not *real* unless it takes all factors into account. This position may appear to overcome contextualism, but only at the cost of misinterpreting the human activity of explaining as the Herculean, divine task of grasping the totality. But even if such a God's-eye perspective were available, we would still be left with the task of picking out which factors from among this infinite set are relevant to reducing the puzzlement of the inquirer.

The relevance of factors is typically due to pragmatic interests, often related to issues of control. In explaining the cause of an accident, an investigator is not likely to attribute it to gravity or inertia, but rather to black ice or to inappropriate all-season tires. Of the vast myriad of necessary factors involved, causal explanation picks out one (or a few) -- "the cause" -- for pragmatic reasons: it is the one we might possibly be able to change, it allows us to assign blame, or whatever. For example, for centuries we have known that oxygen is a necessary condition for cancer: if we deprive a patient of oxygen their cancer dies. Unfortunately, the patient does too. Accordingly, no one calls oxygen a cause of cancer. This is a pragmatic issue: in the medical context of preserving life, oxygen is not labeled the causal explanation of cancer.

The pragmatic and contextual nature of causal explanation becomes particularly evident when we think about different levels of cause. In economics, we know that increasing the money supply causes inflation. Our Absolutist may object that the only real causes are physical ones. But even if we accept that a true account of events can be given on the molecular or quantum level, we should not conclude that economic causes are not explanatory. Causality should be understood as a mode of explanation, not as some absolute metaphysical principle. The principle of causality, "every effect has a cause," does not itself explain anything; it is a formula, a form, a recipe or template telling us what to look for in any particular case. If we are puzzled about why the ball falls in the pocket, the formula tells us to look for an event that will qualify as a cause. As a mode or form of explanation, causality is as valid on higher-levels ("supervenient") of explanation as on lower ("subvenient") ones. It is a mode of thinking, a way of making things intelligible to ourselves. Economic causes are *freestanding*: they inherit their validity from the context of economic theory and do not derive it from any subvenient molecular account, however true that lower-level account may be. They explain in their own right.

To put the same point another way, causality is not a principle of physics but a method of explaining that is medium-neutral. Early modern mechanistic thought may have conceived of causality as an ontological relationship between the ultimate metaphysical entities (atoms, vortices) that make up the physical universe. It is better to think of causality as an instrument for making the world intelligible, a logical structure that may be applied validly to any level of phenomena, physical, molecular, biological, psychological, economic, or whatever.

To summarize: all explanation aims at the reduction of puzzlement and so is essentially contextual. Causal explanation is one way of reducing perplexity, one pragmatic mode of making our world intelligible, and so is not tied to any one kind or level of reality. Each level of causal explanation is independent or autonomous in the sense that its validity does not depend on it being absolute (that is, isolated from a context), complete, or derived from some underlying process.

## II Teleological Explanation

What I have said so far applies either to explanation in general or to causal explanation. Let me now turn to teleological explanation. A teleological explanation explains by appealing to a *telos*, an end.

- Why is anti-body x present in my blood-stream?

- It is there *in order to* protect me from the flu.

It is the end (T), protecting me from flu, which explains the event (E), the presence of the antibody.

“Modern” science, as early as the 17th century, largely rejected teleological explanation.

Preoccupation with purposes had for centuries diverted attention from mechanical causes and hindered the growth of the approach characteristic of modern science. In the seventeenth century, remarkable success was achieved by concentrating on physical explanations and “efficient” rather than “formal” or “final” causes. ... The virtuosi believed there were divine purposes in nature but held that they should play no role in the scientific account. (Barbour 29)

This position was double-edged: it served to excuse scientists from having to deal with purposes and values; but it also protected scientists from recriminations by theologians: “the purposes of God are inscrutable.” This strategy, however, left teleological explanation with a halo of theology, from which it has not entirely escaped today.

This suspicion of appealing to ends may well be behind the traditional philosophical objection that teleological explanation explains the past by the future, that it involves “reverse causality,” since the explanatory cause, protecting me from the flu, occurs after the presence of the antibody, the event being explained. The idea that the future can affect the past is so clearly mystical and unscientific that many scientists and philosophers of science even today simply dismissed teleological explanation out of hand.

I think this objection is based on a verbal mistake, or maybe a mistranslation. Much of the confusion comes because Aristotle is said to have distinguished between “efficient cause”, which comes before the event being explained, and “final cause,” which comes after the event. But Aristotle, of course, did not speak English and so never used the word “cause” at all. The Greek term he used was *aitiā* (αἰτία) which means something like “responsible factor,” “any answer to a ‘why’ question,” “any reason why,” or simply, “any ‘explanation.’” As Moravcsik puts it:

Since *aitiai* are whatever answers a ‘why’-question, and whatever answers a ‘why’-question is an explanation, it follows that an *aitia* is simply an explanatory factor, whatever this may be. Confirmation for this interpretation comes from the illustrations that Aristotle gives in

Ch. 3 and 7, of the same book of the Physics. The illustrations, jointly, do indeed cover the wide spectrum of explanations referred to above. In view of this evidence it is quite misleading to refer to the theory of *aitiai* as the doctrine of causes. It is, rather, a theory about the structure of explanations. (Moravcsik 3)

When, in the modern period, the word "cause" came to be used exclusively for efficient cause, a cause which precedes its effect, the mistranslation "final cause" (cause by reference to the goal) led to teleological explanation appearing to be "reverse causality," a clearly incoherent notion. If "*aitia*" is translated as "mode of explanation," then teleological explanation does not refer to one of four "causes," but is simply a different mode of explanation than (efficient) causal explanation. It explains without reference to the notion of cause at all.

If it does not explain by appeal to causes, what does teleological explanation appeal to? How does it work? Building on an inspiration of Charles Taylor, Larry Wright proposes a logical structure something like this (based on Wright 39 & 81, severely modified):

"An entity or event, E is teleologically explained by the telos T" means

- (i) E tends to bring about T
- (ii) E occurs because (i.e., it is brought about by the fact that) E tends to bring about T.

This is a complex logical structure. Note that (i) refers to the bringing about of the end, T, while (ii) concerns the bringing about of E, the event (entity or explanandum) that we are explaining. By itself, (i) has no teleological implications: rainstorms (E) flood my basement (T), but it does not follow that flooding my basement is therefore the purpose of rainstorms. In contrast, while (i) the presence of antibodies (E) tends to protect me from the flu (T) -- a purely causal sequence -- it is also true in this case that (ii) the antibodies are in my bloodstream (E) precisely because they tend to protect me from the flu (T), and it is this additional second clause that makes the complex structure into a teleological explanation. Only if rainstorms occurred because they flood my basement (ii) -- could Zeus be consciously directing the weather to get back at me for something? -- would the rainstorm be teleologically explained.

In this analysis, there are no temporal abnormalities, no hint of reverse causation. The two explanatory factors are already in place before the event to be explained. That these antibodies tend to protect me from flu (i) is a scientific fact that is valid before, during and after the event we are

explaining. If it is due to this fact that the antibodies occur (ii), then the explanation makes no appeal to any future event, goal, or end, but to the *tendency* that is there as much before as after.

It is the tendency, then, which brings about the event. It explains why this event, rather than some other, occurs. The event is, as Wright puts it, selected from among alternative events which might have occurred, precisely because of this tendency. After all, the point of explaining is to respond to our puzzlement: why was it this event that occurred rather than something else? That the *tendency* explains the *selection of E* is crucial to this analysis.

The validity of this logical analysis of teleological explanation does not depend on *how* the tendency results in the event being explained. As long as it does, our explanation is a teleological one; that is all that matters. Nevertheless, it is not immediately evident how a tendency can bring about an event. If the account is to be plausible, we need to investigate how this might be possible. Wright investigates two different ways that a tendency might bring about an event.

First, there is the case of conscious intention. If the tendency of the antibodies to protect me from the flu is something I come to know or believe in, then I may intentionally take steps to produce the antibodies in my bloodstream, for example, by getting a flu vaccine. In this case the tendency results in the event *by means of* my belief and intention. Behaviours that are directed by conscious intentions make up one class of events which can be explained teleologically. Wright labels the class "directed behaviour."

Secondly, the Darwinian process of natural selection may also be *a means by which* a tendency can bring about an event. About 15 years ago I actually did get influenza. My immune system responded by pumping antibodies into my bloodstream, and it has maintained them there since *in order to* protect me from the same virus in future. In this case there is no conscious intention involved. My immune system is able to do this because, over hundreds of millions of years, only organisms that responded to viruses by producing the appropriate anti-bodies ended up surviving. Wright labels this class of teleological events "functions."

Wright insists on speaking of "tendency" to take account of the fact that in the case of both conscious intention and natural selection, the regularity with which E brings about T does not have to be rigid or invariant, as would be the case if he used the notion of "cause." When I formed the intention to get vaccinated, I believed that the flu shot is only 70% effective -- it *tends* to protect me from the flu -- but that was enough to for me to opt for vaccination. The immune system, in the case of natural



selection, bet on similar odds: the antibodies did not have to be 100% effective for their production to give my ancestors a survival advantage.

The term "tendency" has one other advantage. It brings out the fact that the *basis* for the tendency is irrelevant. I assume that there is a biochemical cause for the tendency of antibodies to protect me from flu, but if I were wrong, if the tendency were due to other (quantum?) causes, to non-causal magical or astrological forces, or even to the fairly regular intervention of God, the logical structure of the teleological explanation would remain valid. That is, while there must be *some* subvenient processes underlying the tendency, the explanatory power of the teleological explanation does not depend on them.

If we grant that there are two subclasses of teleological explanation, it might be possible to give a teleological explanation without yet knowing to which subclass it belongs. We might, for instance, be able to figure out that it is the function of certain antibodies to protect against a specific virus, while being ignorant of whether the antibody evolved naturally, or was intentionally produced by vaccination. We might explain that an individual's heart is present in order to pump blood, while not knowing whether the heart is natural or artificial.

Finally, Wright's formula above for teleological explanation is like the principle of causality in that it itself explains nothing. It is a form, a template that tells us how to construct any actual explanation. If you are wondering why there are hearts, look for some end, some function that the heart accomplishes. If you are baffled about why people vote, search out some goal that voting achieves. As a mode of explanation, teleological explanation is not tied to the mental, to the biological, or to any other, order of being; it is an instrument for rendering the world intelligible, so if it reduces puzzlement about hearts, thermometers, antibodies or voting, use it. As a mode of explanation, it is medium-neutral.

### **III Evolutionary Explanation**

#### **A. The Nature of Evolutionary Explanation**

My claim is that evolutionary explanation is also a mode of explanation – a template – that has a similar logical status to that of causal and teleological explanation. Evolutionary explanation is based on the Darwinian process of adaptation by survival of the fittest. As I define it, an evolutionary explanation explains the existence of some object, process, organ, species, or system by appeal to its historical differential fitness to survive in competition for some limited resource. Any such explanation requires three components:

1. Replication -- Some way of preserving traits from generation to generation;
2. Mutation -- Some mechanism by which some of these traits can be occasionally modified;
3. Competition -- Some regime that limits resources needed for survival from one generation to the next.

For example, humans have opposing thumbs because these thumbs gave our ancestors, when they descended from the trees, a replicative advantage over other species who did not. This is an explanation which addresses our puzzlement about why we have opposing thumbs. It is an evolutionary explanation.

This is not a causal explanation. Descent from the trees does not *cause* opposing thumbs, either as a general law or in any specific case. Maybe, over millions of years, cosmic rays occasionally resulted in genetic mutations which caused opposing thumbs in some individual primates. That would indeed be at a causal explanation. Nevertheless primates in general -- as an Order -- did not develop opposing thumbs. Indeed, this causal account doesn't even explain why most primates *don't* have opposing thumbs. The explanation for that absence is that such primates were badly adapted to swinging on the trees, obtained less food, and so reproduced less well than primates with the appropriate thumbs. Similarly, the presence of opposing thumbs in hominids cannot be explained by whatever caused the genetic mutation for thumbs (although that was a necessary condition.) It is not the cause of the mutation that explains why humans have thumbs: it is the advantage of opposing thumbs in subsequent natural selection that explains their presence in humans.

Nor does natural selection give a teleological explanation. There is no goal or function to adaptation. Primates with opposing thumbs did not grow them in order to produce the human species. It is simply that, given the environment at the time, some variations happened to replicate better than others. There is no Mother Nature with a predetermined aim in view.

So, evolutionary explanation is neither causal nor teleological. It is *sui generis*.

Despite these examples, evolutionary explanation is not essentially biological. Just as causality is not limited to physics, nor teleological explanation to the mental, so evolutionary explanation should be understood as a logical structure, as one other mode of explanation as distinctive as, and on a par with, causal and teleological. We can summarize the three-component formula by referring to the principle of survival of the fittest, but as before, we should be clear that this is a form, a template, that in itself explains nothing, just as the principle of causality explains nothing. For any actual explanation, we

need to fill in the slots in the template, that is, we need to exhibit some specific method of replication, say what kinds of mutation occur, and describe a particular mode of competition. Outside of biology, for example, the survival of the fittest principle explains the existence of computer viruses. Replication is by transmission between computers, mutation involves hackers trying new versions of the virus, and the competition is for computing resources in the face of anti-viral defences. The principle can also be used to explain why monetary systems of exchange superseded barter. It explains why most modern societies have schools: societies without them are doing poorly. It explains why most corporations advertise: those that did not are not around anymore. Evolutionary explanation is medium-neutral, that is, it is not tied to biological processes, but is a stemplate for explaining the dynamics of any system with some form of inheritance of properties, some variations or mutation of characteristics, and a competitive environment. It is a mode of explanation, not a biological theory.

Evolutionary explanation is also self-standing in the sense that, like causal and teleological explanations, the details of the subvenient processes are more or less irrelevant. Computer viruses thrive today in electronic computers. If we develop optical computers, or quantum computers, the evolutionary explanation for the existence of computer viruses will not change. If the mechanical computers envisaged by Leibniz (and partially implemented by Babbage) had developed to the point where they could be Interneted, you can be sure that viruses would have infected them too. Similarly, a century after the time of Mendel and Darwin, we discovered that the process that underlies biological evolution is based on the properties of DNA, but had we discovered that biological inheritance and mutation were implemented by some entirely different biochemical mechanism, the explanatory value of biological adaptationism offered by Darwin would have suffered not a whit. To say that evolutionary explanations are freestanding is to say that their explanatory validity depends on themselves and does not derive from any underlying causal or teleological processes that instantiate them.

### **B. Evolutionary Accounts Explain by Means of Contingent Regularities**

On this autonomous or freestanding level, evolutionary explanation invokes contingent laws or conditioned regularities. To unpack this claim, I need to approach it indirectly.

It can be said that Newton's law of gravity explains the patterns of planetary motion discovered by Kepler. This is half right. The law of gravity explains the dynamics of the solar system, but only if it is supplemented by other information, namely, the initial conditions to which the law is applied. Unless

we know there is a sun with a certain mass, and that there are eight planets at various distances from the sun, the law of gravity explains nothing. Scientific explanations are composed of two components: laws or regularities, and conditions, by which I mean the circumstances, initial and otherwise, under which these laws operate.

Some laws are universal. The law of gravity, or Charles' Law (gases expand when heated), are valid for all places and times in the universe. Local conditions may be relatively stable, and this stability can give rise to conditioned regularities, that is, laws that, although not universal, may be valid for many places and times, namely, those for which the relevant conditions apply. Kepler's laws of planetary motion, for example, have been valid in our solar system for about 5 billion years, and apply in other places wherever there are exoplanets orbiting a star. Even more locally, pressing the accelerator increases the speed of cars, and this regularity may be used to explain hundreds of billions of events on the earth in the last two centuries. Nevertheless, unlike Charles' law, this is not a universal law, but a conditioned regularity, a contingent law: the conditions are the structures of the internal combustion engine.

Some purists, let me call them Universal Legalists, may claim that only appeal to universal laws is really explanatory. A *real* explanation, they say, would rely on the laws of chemistry or physics, which would be the same everywhere and eternally. But they are wrong. Even about cars!

How can we explain why a car moves? Because gas, introduced into the cylinders, is ignited, it gets very hot and, in accordance with Charles' law that gases expand when heated, forces the pistons down and drives the wheels. This causal account is correct, as far as it goes. But maybe this is not what I was curious about. Perhaps I already knew about Charles' law. While Charles only discovered his law in the 18th century, the causal regularity that bears his name has been around more or less since the beginning of the universe. Only in the last couple of centuries, however, have there been auto-mobile devices; Charles' law did not explain cars a million years ago. The curiosity expressed by my "why" question may be about the novelty of the current situation. The explanation that will put this puzzlement to rest will have to make reference to the conditions in which Charles' law operates, namely the design of the cylinders, pistons, and the engine in general. These structures, however, are not universal, but contingent. So the Universal Legalist is wrong: The explanation by contingent regularities is a perfectly adequate explanation; it is as real as they come.

Worse than wrong, the Universal Legalist, in many contexts, has it backwards. If I am curious about why Charles' law works for cars -- it doesn't for bicycles -- or why the law of gravity might not explain the piston moving down, the answer is to be found by giving the conditions. It is because the engine has a particular structure that Charles' law, rather than the law of gravity, is involved. In many contexts of puzzlement, it is the account of the conditions that tells us why this universal law rather than the other is to be invoked. If I don't understand the structure of the engine, mentioning Charles' law fails to address my curiosity. In this context, it is the account of the conditioned regularities that carry the burden of explanation.

Biological laws are conditioned regularities in this sense. That mammals have four-chambered hearts has been true on our earth for billions of organisms over the past 200 million years. Some explanations based on these biological laws are causal: teeth decay because they are infected with certain bacteria. Other explanations are teleological: the heart pumps in order to circulate blood; humans act intentionally in order to accomplish conscious purposes. In either case, the regularities are conditioned regularities and so must be understood in terms of their historical evolution.

Evolution is a cumulative process of building contingent conditions upon previous contingent conditional structures. In the beginning, universal laws reigned. The early conditions under which these universal laws operated led to new, more local regularities. The conditions under which these secondary laws operated led in turn to even more local, tertiary laws. You might think of this as a kind of historical dialectic in which preestablished laws, operating under contingent conditions, establish a new level of regularity. Faced with a new set of contingent conditions, these laws in their turn establish new ones. As this historical accretion of contingent conditions develops, opportunities for new explanations appear. If puzzled by the fact that mammals suckle their young, we can refer to the regularity that mammals give birth to immature offspring and the condition that food is not readily available to such offspring without adult help. If we wonder why someone fulfills a promise, we can point to the contingent evolution of selves – beings who regularly take responsibility for their own previous commitments.

Since explanation is contextual, these questions are adequately and most appropriately answered by offering the conditioned regularities that can be explained by evolution. This is not to say that there may be some puzzles to which we should respond with a universal law; what I am rejecting is the Universal Legalist claim that *only* the universal laws *ever* give the *real* explanation.

Evolutionary explanation, then, is explanation by contingency, by appeal to historical, conditioned regularities, rather than to unconditioned, universal laws. Evolutionary explanations are freestanding: they explain in their own right.

## **IV Reductionism**

The freestanding or autonomous nature of evolutionary explanation does not mean that it is unrelated to causal or teleological explanation. These relations are everywhere, and go in every direction. For example, an upper-level causal explanation showing that inflation is caused by an increase in the supply of money only makes sense in a monetary system, but the existence of such a system can itself be explained on an evolutionary basis. That the function of the heart is to pump blood -- a teleological explanation -- can itself be explained by evolution. Going in the other direction, a causal account can be given of the components of evolution: genetic mutation is caused by DNA variation; faster reproduction of a species is caused by better access to food. So just as causal and teleological explanations may sub- or supervene on each other, evolutionary explanations may sub- or supervene on the other two.

The many relationships between modes of explanation must not be misinterpreted as reductionist. What is "reductionism?" Sometimes I fear the term is brandied about in a purely rhetorical way, as a pejorative term for positions with which one disagrees. As I define the term, a reductionist is one who holds that when two levels of explanation are available, the subvenient level always trumps the supervenient one. That is, the supervenient explanation is to be declared illusory, unscientific or superficial, while the lower level is declared to be the only real explanation. Often the upper-level being decried is teleological while the subvenient level is mechanistic or causal, but this need not be the case. For example, explaining inflation by money supply (a causal example) or explaining the heart by its function (teleological) may both be declared folksy or prescientific, while the real explanation for these events is to be given in terms of the movement of molecules. The Absolutist version of reductionism is the claim that there is one ultimate level, the only one that offers real explanation -- perhaps quantum mechanics or string theory -- to which all others must be reduced if we are to be scientifically pure.

There are two kinds of people who embrace reductionism, in the sense I have defined. First there are those who support the scientific worldview and think that to justify this they must defend physicalism, that is, the claim that only physical accounts are ultimately explanatory. The second kind are those who value human consciousness and freedom, or perhaps even higher spiritual realities, and, believing that the scientific view is a threat to their beliefs, defend reductionism as a kind of *reductio ad absurdum* so that they can discredit the scientific approach in its entirety.

Whatever the motivation, reductionism, as a blanket strategy, is wrong. It is wrong because explanation is contextual. That inflation is caused by increased money supply is a valid explanation which responds adequately to a particular puzzlement, regardless of whether the monetary system is to be explained by evolution or in some other way (perhaps it was God that invented money.) Similarly, that, in an environment full of antiviral programs, some computer viruses survive while others die out is adequately explained by evolution regardless of the nature of the underlying enabling processes -- electronic, optical, quantum or mechanical. If the context involves the control of inflation, one had better explain it in terms of money supply if one is to successfully intervene. The Governor of a Central Bank who insisted on molecular levels of explanation is not likely to keep her job long! If my heart gives out, I need a surgeon who is concerned about whether an artificial heart will perform the same function as my old biological one, not someone who claims that, since the new heart is to be explained by subvenient electro-mechanical laws rather than neuro-muscular ones, it is a radically different entity and so unsuitable. Since explaining is a human and contextual activity, each of the three modes of explanation possesses its own intrinsic validity, despite the dogmas of reductionists.

This is not to deny that reductionist explanations may be appropriate under some circumstances. It depends on the context of puzzlement. The mistake is to think that reduction is *always* the way to go. The fundamental error of dogmatic reductionism is to conceive of explanation as in-itself, as non-contextual. It is to assume that one explanation is *intrinsically* superior, or that there is an ultimate explanation beyond all context. This is the hubris of the God's Eye View. There is no ultimate, context-free perspective. Explaining is a human activity.

## CONCLUSION

My aim has been to show that causality, teleology and evolution are not metaphysical principles bound to physical, mental or biological ontologies but are ways that humans have devised to resolve their puzzlements within the context of inquiry. Each of the three modes of explanation is freestanding, valid in its own right and independent of subvenient levels for its explanatory power.

If this analysis is right, then we have nothing to fear from the scientific worldview. We can embrace the causal and deterministic world order offered to us by science without jeopardizing that capacity we consider essential to our humanity, to our existence as selves: our ability to act for an end.

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