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A framework for inter-level explanations: Outlines for a new explanatory pluralism

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ABSTRACT

According to explanatory pluralism, the appropriate explanatory level is determined by pragmatic factors, and there are no general exclusion or preference rules concerning higher- or lower-level explanations. While I agree with the latter claim, I will argue that the former is in need of revision. In particular, I will argue that by distinguishing cases of two explanations being descriptions of one underlying causal process, and two explanations being descriptions of two distinct causal processes, it becomes clear that the grain size of an explanation is in fact determined by the interplay of various pragmatic and non-pragmatic factors. Within these constraints, positive guidelines can be developed to direct us to the appropriate explanatory level. This gives us the outlines for a general framework for classifying various types of relations between explanations on different levels. After making a comparison between this new framework and standard explanatory pluralism, I end by suggesting some ways in which the framework could be further developed.

1. Introduction

This article is about inter-level explanations. Because these terms can be used in a variety of ways, let me start by making some clarifications. First, I shall assume what I call a scientific disciplines account of levels. That is, with 'level' I mean a *level of description*, or a specific grain size, through which phenomena are studied and explained, not levels in nature.[1] Thus, when I speak of an inter-level explanation, I mean that the explanandum and the explanans are couched in different scientific vocabularies. Obviously, on this account an intra-level explanation is an explanation where the explanandum and the explanans are couched in the same scientific vocabulary.

Second, I shall restrict myself to situations in which multiple explanations address the same explanandum, with at least one of these being inter-level with respect to that explanandum. Third, although formulated like this, the issue is neutral with regards to whether the inter-level explanation is at a higher or a lower level than the explanandum, I will mainly focus on the latter type of situation. Thus, to illustrate these three points, an example of the type of situation I am concerned with is when a psychological state like 'being depressed', is simultaneously addressed by an explanation couched in psychological terms (e.g. feelings of neglect during childhood) and a neurophysiological explanation (e.g. reduced serotonin levels in the prefrontal cortex). From now on, I shall use the phrase 'multiple inter-level explanations' as shorthand expression for situations like this. Finally, this paper deals with *causal* explanations. I do not wish to suggest that non-causal (e.g. mathematical) explanations do not exist, but this article is not about them.

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[1] This assumption is not innocuous. Craver, to name just one example, favors an ontological account of levels when it comes to multi-level explanations in neuroscience (2007 p. 177). Of course, adopting a scientific disciplines account of levels does not mean there will never be differences in ontology; it just means that when it comes to differentiating levels, I will draw upon scientific vocabulary rather than ontology.

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In any case, when we have multiple inter-level explanations, which one should we go for?[2] Do we prefer the explanation that addresses the target phenomenon at its own level, or do we prefer a lower-level explanation? Of course, if we maintain that one of these levels is somehow privileged over the other, we end up with positions such as reductionism or eliminativism. If, on the other hand, we believe that there is no privileged status for any level, then we might opt for some form of methodological dualism. Alternatively, we might say that these relations apply only locally. That is, though there might be cases of reduction or elimination, these relations as such do not represent essential ingredients of scientific progress. This latter position has become known as explanatory pluralism (McCauley, 1996, 2007; McCauley & Bechtel, 2001).

Of course, the history of science testifies to successful local reductions and eliminations, and these are not ruled out by explanatory pluralism. The point is that as the grand, sweeping theories such as classic reductionism and methodological dualism fell out of favor, philosophers increasingly realized that explanations of different grain sizes coexist and exert mutual influence on each other. Rather than on philosophical ideology, the choice of grain size depends on contextual or pragmatic factors.

It would be unfortunate however, if this is where the theorizing stops, i.e. if the claim that pragmatic factors determine grain size is viewed as a terminus for the philosophical debate about inter-level explanations.[3] In my view, this picture is at best incomplete. While it is true that pragmatic considerations play an important role in selecting or emphasizing a particular explanatory level, there are also other, non-pragmatic ontological factors at work.[4] However, their influence is not deterministic: although it puts constraints on our choices and preferences, within those constraints, there is ample room for pragmatic considerations to come into play. Moreover, the fact that pragmatic factors play this role does not mean that anything goes: as we shall see, it is possible to draw up guidelines to help us understand just what pragmatic factors are at work, and how they lead us to emphasize one explanatory level over the other. Thus, although the explanatory pluralist is right in stating that reduction, elimination etc. apply only locally, it does not follow that they apply randomly. To make sense of the choices scientists make when confronted with multiple inter-level explanations, we need to understand the subtle interplay of pragmatic and ontological factors that influence these choices.

In this article, I offer a framework for classifying both pragmatic and non-pragmatic factors influencing our preferences for particular levels when providing or pursuing causal explanations. I will argue that although this framework stays true to the basic tenets of explanatory pluralism, it represents a step forward, in that it identifies situations in which ontological factors constrain the influence our pragmatic interests have, and offers guidelines that help us to understand the choices made by scientists. Although the result will be a general conceptual framework, rather than a finished product, it does clearly point to ways to augment and refine it with subsequent research. As such, the framework presented at the end of this article has a programmatic character.

Here is an outline of the paper. First, I will briefly present what I take to be the central claims of explanatory pluralism (Section 2). Next, I will introduce a distinction between situations in which multiple inter-level explanations cite one underlying causal process, and situations in which they cite multiple, genuinely distinct causal processes (Section 3). While the debate between explanatory pluralism and reductionism (of various sorts) seems to mostly focus on the former type of situation, in this article, I will concern myself with the latter type. Combining the previous material with a distinction between relevant causal factors and productive causes, I draw up a preliminary taxonomy of types of relations that can obtain between multiple inter-level explanations (Section 4). I then introduce some pragmatic factors that influence our choices to emphasize one explanatory level over another (Section 5) and draw on these factors to construct three guidelines that help us to make such choices, and understand the ones made by scientists (Section 6). I will illustrate how these guidelines work in practice by considering a case study, namely multiple inter-level explanations of the Korsakoff syndrome (Section 7).

Next (Section 8), I shall present my conceptual framework. I will contrast it with standard explanatory pluralism, and argue that although it stays true to the general spirit of explanatory pluralism, it does suggest a more nuanced picture of the ways multiple inter-level explanations can relate. I will end by considering some ways the framework might be expanded in the future.

2. Explanatory pluralism

In contrast to traditional reductionism or eliminativism, explanatory pluralism acknowledges the multiplicity of explanation. Explanations at different levels can exhibit anything from reduction to mutual co-evolution, from elimination to integration. Rather than strict ontological commitments, the identities postulated between the entities of lower- and higher-level explanations are at best heuristic and hypothetical in character, open to revision or abandonment as the need arises (McCauley & Bechtel, 2001). Typically, descriptions of one phenomenon at different grain sizes can exist simultaneously, mutually influencing each other. In due course, it might be that one is discarded, but there is no guarantee that this will always be the higher-level explanation. In fact, it is argued, furnishing explanations at multiple levels fuels scientific progress (Bechtel & Richardson, 1993; Hardcastle, 1996; Looren de Jong, 1997). With this in mind, we should not only focus on the diachronic dimension of theory succession, as reductionists tend to do, but also allow for synchronic co-evolution of explanations (McCauley, 1996, 2007; Schouten & Looren de Jong, 1999). Ultimately, for explanatory pluralists, the choice of grain size is determined by pragmatic factors operative at a given moment, i.e. on what you want to achieve with your explanation.

The basic claims comprising explanatory pluralism can be summed up as follows:

1 It is impossible to rule out explanations of any specific grain size in general.
2 It is incorrect to claim that explanations of one specific grain size are always superior to explanations of another grain size.
3 Having multiple inter-level explanations can be beneficial to scientific progress (both diachronic succession and synchronic co-evolution should be allowed).
4 The choice between grain sizes is decided by pragmatic factors.

[2] As we will see, the issue is not always one of choosing between different explanations: sometimes, different explanations are actually complementary and can be integrated into a single, compound explanation, so that the issue is not a choice between explanations, but a choice to *emphasize* one part of an explanation over another part, given some practical purpose. In Section 4, I will discuss this issue in more detail.

[3] Which is not to say that no one has ever attempted to explicate these factors—see Section 2.

[4] The distinction between pragmatic and non-pragmatic factors may not always be clear cut, and within the scientific pluralism literature, authors may draw the boundaries somewhat differently. Although a rigid distinction is not necessary for the arguments I will develop in this article, in general, pragmatic factors are factors that have to do with our own interests or motives (unification, prediction etc.), while non-pragmatic factors are imposed on us by the world, independently of our interests.

I will refer to the conjunction of these claims as *standard* explanatory pluralism.

In any case, it is with the fourth claim that I shall be mostly concerned. Many authors now agree that grain size is determined by pragmatic factors. Here are a couple of quotes I take to be representative of this view:

> Which grain is more appropriate depends upon the problems under consideration (McCauley & Bechtel, 2001 p. 753).
>
> Grain size is a context-dependent and theory-relative, ultimately empirical affair (Looren de Jong, 2002 p. 446).
>
> In claiming that it is a matter of taste whether we prefer the macro- or the micro-explanation, I am claiming that there is no objective reason to prefer the unified over the disunified explanation. Science has room for both lumpers and splitters (Sober, 1999 p. 551).

Let me make two related comments here. First, although I agree with the gist of these statements, it would be a mistake (so I will argue) to conclude that the preference for or choice of a particular explanatory level is decided by pragmatic factors alone. Second, explanatory pluralism could be made into a more interesting position if we try to identify these pragmatic and non-pragmatic factors, and show just how they influence our choices. To use Sober's terminology, there may be room in science for both lumpers and splitters, but that does not tarnish the fact that in a given case, one is either a lumper or a splitter. As philosophers of science, we owe an answer to the question why we make the choices we make.

Of course, I do not wish to suggest that the authors cited here think that the pluralist conclusion they draw is *necessarily* a terminus, nor that attempts have never been made to explicate these pragmatic factors. To be sure, there is a sizable literature devoted to the goals of explanation, to which the authors just quoted have themselves in various ways contributed. McCauley and Bechtel for instance (2001 p. 753), refer to Bechtel & Mundale, 1999 as arguing for the claim that fine-grained analyses in biology are often more useful when considering individual differences or differences in a single organism over time, while coarse-grained analyses are often employed when answering evolutionary questions. Also, much has been made of intervention, control and manipulation as goals of explanation. For example, about causal explanation Woodward writes: "the distinguishing feature of causal explanations (…) is that they are explanations that furnish information that is potentially relevant to manipulation and control" (2003 p. 6). Similarly, Craver states that "Explanations in neuroscience are frequently developed with an eye to possibilities for manipulating the brain (…) the discovery of mechanisms provide scientists with new tools to diagnose diseases, to correct bodily malfunctions, to design pharmaceutical interventions, to revise psychiatric treatments, and to engineer strains of organisms" (2007 pp. ix–x).

While I fully agree that intervention, control and manipulation are important pragmatic factors to take into consideration, just how these goals relate to the issue of grain size, is often left at an intuitive level. The central aim of the framework I will construct is to offer us a handle on how pragmatic interests like control and intervention, work together with other, non-pragmatic factors, to influence our preference for a particular explanatory level in a given case.

3. How many causes?

As I have said in the introduction, I am concerned with cases of multiple inter-level explanations. However, this phraseology hides an ambiguity that, although by no means controversial, is not usually noted in the context of comparing explanatory levels.

Sometimes, two explanations of different grain sizes will refer to same underlying causal process. This is the situation we are naturally inclined to consider in the context of positions such as reductionism and methodological dualism. For example, we might explain a person's risk avoiding behavior by referring to a childhood trauma brought on by an accident; alternatively we might explain the behavior by referring to the altering of intracellular chemical constituents (e.g. a second messenger like phosphatidylinositol), brought on by a previously occurred shift in patterns and quantity of neurotransmitter release (the neurophysiological response to the accident). In this vein, the psychological explanation might be thought of as referring to states that are functional descriptions of activity in certain brain regions. Both the intra- and the inter-level explanation cite one underlying causal process leading up to the explanandum, although both describe this process in different scientific vocabularies. The competition here is between different descriptions only.

Sometimes however, two explanations are descriptions of two distinct causal processes. For example, consider a person who is genetically prone to clinical depression. Suppose this person develops a depression after learning that one of his relatives has died. In this case, we have two separate causal pathways that converge to produce the explanandum: on its own the genetic risk of depression would not have caused depression but for the contingency of the relative dying, while this contingency will not typically result in clinical depression in persons who are not genetically at risk of developing the condition in the first place. In other words, the cause of the mental condition of depression is typically a mixed bag, including both genetic and environmental factors.

Straightforward as this distinction might seem, it is crucial to understanding the interplay between pragmatic and ontological factors influencing the choice of or preference for explanations at specific grain sizes. The point is that explanatory pluralism and traditional versions of reductionism seem to apply specifically to those cases of multiple inter-level explanations where there is only one causal process. That is, they are positions about the relation between different descriptions of the same cause. Reductionism was traditionally married to the idea that the entities or processes referred to by the reduced science were none other than those referred to by the reducing science (in the philosophy of mind, this took the form of the so-called identity theory, or central state materialism). Explanatory pluralism, for all its tolerance of multiple, co-existing levels of description, has inherited this tendency to erect bridges between higher- and lower-level entities and processes. The fact that for explanatory pluralism, those bridges are not ontological commitments, but merely heuristic identities that are maintained only as long as they are fruitful (McCauley & Bechtel, 2001), does nothing to assuage this fact. Heuristically understood or otherwise, it simply makes no sense to talk about an identity relation between genetic proneness to develop depression, and learning of the death of a relative.

To be fair, both explanatory pluralism and reductionism in its latest form, Bickle's (1998, 2003) New Wave Reductionism, at least implicitly recognize this distinction by acknowledging the possibility of local elimination, not just of descriptions, but also of ontology ('bumpy' as opposed to 'smooth' reduction). This thick notion of elimination, in which the abandonment of an explanation is accompanied by an elimination of the entities and processes referred to by that explanation, is only applicable to cases where multiple inter-level explanations describe genuinely distinct causal processes.

In any case, there are interesting stories to tell about situations where the only competition is between descriptions at different

levels of the same causal process. I assume that here, explanatory pluralism is basically correct.[5] That is, which level one chooses will depend on pragmatic factors, such as possibilities for intervention (answering a greater range of what-if-things-had-been-different questions), completeness, communicability to the general public (with explanations couched in psychological vocabulary presumably being easier to communicate to laymen than neurophysiological ones), etc. It is easy to see that in such cases, reduction, independence,[6] and elimination (in its thin variety, i.e. without eliminating its ontology) indeed apply only locally.

Nevertheless, it should be evident that the distinction between descriptions of a single cause and descriptions of multiple causes is itself hardly a pragmatic factor. Yet it can constrain the range of possible relations between two given explanations. In the example of the person suffering from depression, even if we have very good pragmatic reasons for preferring the intra-level explanation (i.e. learning about the death of a relative as opposed to the genetic proneness to develop depression), still this will not give us the full causal story. Consequently, although in accordance with explanatory pluralism, elimination can apply locally, it cannot apply to this particular case. Of course, this has to do with the fact that these two explanations, far from being in competition with each other, are actually complementary (more on this in the next section).

In the remainder of this paper, I will be mainly concerned with multiple inter-level explanations citing distinct causes, as it is here that standard explanatory pluralism falls short. First however, it should be noted that in these situations, elimination is not *necessarily* ruled out—indeed, sometimes it is the only possible outcome. To see this, we need to make a further distinction.

4. Relevant causal factors versus productive causes

One may explain something by referring to *causally relevant factors*, or to a *productive cause* of the explanandum. Suppose we say that the window shattered because it was hit by a baseball. In such a scenario, the baseball's hardness may be a causally relevant factor in the sense that had the baseball's hardness been different, the window would not have shattered. Similarly, if we say the baseball being white was not a causally relevant factor, we mean that if it were another color, the window would still have shattered. In this case, the causally relevant factors are properties of the baseball. But causally relevant factors may also pertain to the window (e.g. its hardness) or to background conditions that are not explicitly mentioned in the causal claim (e.g. the strength and direction of the wind). Thus, claims about causal relevance express counterfactual dependencies, which should obtain given certain background conditions.

In contrast, productive causal claims do not have similar modal qualities. If we say that one event produced another, we are making a de facto claim about a causal relation. It might be that the resulting event is also counterfactually dependent on the productive cause, but (for example in cases of overdetermination), this may not be the case. If things had been different, the window might have shattered by some other cause, but the fact is that it is shattered by the baseball.

The distinction between these two types of causal claims may be familiar enough, but as Glennan (2010) notes, underlying them are two very different metaphysical traditions. Productive, sufficient causal claims are associated with a horizontal ontology, of events producing other events in endless causal chains governed by laws. On the other hand, causal relevance claims are often situated in an essentially layered model of the world. Here, the world is partitioned according to the size of the things that make it up. On this account, entities, systems, etc. are aggregates, composed of smaller parts, which are composed of yet smaller parts, etc. As such, this tradition emphasizes a vertical ontology.[7]

It should be evident that this distinction is closely related to the previous one. If we combine the insights about causal claims offered by our discussion of these distinctions, then we end up with four possibilities – see Table 1 below.

Some examples we have considered can be placed in this taxonomy. In the example I used to illustrate the case of two descriptions of one underlying causal process, the causal claim (that risk avoiding behavior was caused by childhood trauma) is of the productive variety, so that this example falls into the bottom left category. On the other hand, in the example illustrating two explanations that are descriptions of two distinct causes, these causes (genetic proneness and a relative dying) are causal factors for developing depression, so that this example fits into the top right category. But it is of course possible to describe the same relevant causal factor, such as genetic proneness, in two different scientific vocabularies. Another possibility is that two explanations for the same explanandum cite two distinct productive causes. If both these explanations are true, it constitutes a case of causal overdetermination. On the other hand, it might be that one of the sufficient causal pathways identified in the causal claim is wrong. For example, it might be that the higher-level sufficient cause turns out to be non-existent, so that what remains is the lower-level sufficient cause—this of course being the favorite case of the eliminativist.

As I have already said, the debate between explanatory pluralists and reductionists (of various plumages) seems to concentrate mostly on the left column. Indeed, it is here that the pluralist claim that pragmatic factors determine grain size applies most directly. When both explanations refer to the same causal process, the competition is between different descriptions only, and there is room for a whole range of inter-level relations, regardless whether it concerns descriptions of a relevant causal factor or a productive cause.

However, if two inter-level explanations cite two distinct causes, the situation is more complex. Suppose they cite different relevant causal factors. In this case the two descriptions are complementary rather than in competition. Indeed, one can combine two such explanations in one compound explanation ('X's depression was caused by his genetic proneness and his relative dying'). Thus, integration is a possibility in this scenario.[8] Here, the pragmatic factors explanatory pluralists refer to influence not the choice

[5] This assumption will be resisted by eliminativists and reductionists. However, as this has been argued for elsewhere (e.g. Looren de Jong, 2002; McCauley & Bechtel, 2001), for the purposes of this paper, I will presuppose explanatory pluralism with respect to situations where the competition is between descriptions only.

[6] I use the term 'independence' to refer to a situation in which the two explanations both continue to exist separately from each other.

[7] Notice that this layered model of the world as such is not at odds with the scientific disciplines account of levels I committed myself to in the introduction. Although in a given case, the position of a relevant causal factor in this vertical ontology can have (some) bearing on what scientific discipline it is studied by, and hence indirectly on the explanatory level, this will not always be the case. To make this latter point clear: it has been noted that physics studies entities ranging in size from molecules and quarks to entire galaxies, while biology covers single cells as well as ecosystems (Bechtel, 2007)—though of course one may legitimately ask whether in such cases we should not talk about sub-disciplines rather than disciplines. In any case, it remains the scientific vocabulary of a discipline or subdiscipline that determines grain size.

[8] I use the term 'integration' to refer to two causal explanations being combined into a single compound one; i.e. not in Mitchell's (2003) technical sense. Unlike cases of independence, these explanations are no longer separate from each other.

between different explanations, but rather the choice on what explanatory level to put the emphasis—or, in the case of integration, on what part of the integrated, compound explanation to focus. In the next two sections, we will see how this works in practice.

In any case, at least conceptually, the descriptions of the different causal factors on both levels retain their distinct identities, even if they are thus integrated. On the other hand, suppose two inter-level explanations cite two distinct sufficient causes. In such a case, one of them has to go (barring causal overdetermination), and the result must eventually be elimination of (at least) one. But which one? Here, there is no principled choice, and it is ultimately the world that decides whether the higher or lower level is retained (which explanation singles out the 'true' cause).

Thus, it is not correct to simply say that grain size is determined by pragmatic factors. Our choice of, or preference for, a particular explanatory level is constrained by non-pragmatic factors, even more so for the situations listed in the right-hand side of the column. Nevertheless, within these constraints, pragmatic factors do play an important role. In what follows, I will focus on situations where we have two descriptions of two distinct relevant causal factors (the top right cell in Table 1) and devise some strategies to help us decide on what explanatory level to focus, given our pragmatic interests.

5. Two pragmatic factors explicated

In this section, I will explicate two pragmatic factors. In Section 6, I will draw upon these to formulate some heuristic guidelines that help us to decide on which explanatory level we should focus when confronted with two inter-level explanations that describe two distinct causal factors. The first pragmatic factor concerns the epistemic interests underlying our explanations, the second proximity of causes.

5.1. Epistemic interests

As should be evident from the quotes in Section 2, it is accepted among most philosophers of science that explanations are always formulated and pursued with some goal in mind; i.e. they are a means to serve certain ends. In so far as these factors or goals concern domains that are associated with the scientific method (theory acceptance, model building, formulating hypotheses, etc.) let us call them epistemic interests.[9]

Thus, one may construct or pursue an explanation with an eye to achieve a variety of epistemic interests. Of course, the first interest that springs to mind is *understanding*, or sheer intellectual curiosity. Understanding is the desire to know, without necessarily having any direct use for the knowledge gained.[10] Other, more practical, epistemic interests include: prediction (arriving at statements describing future effects of causal chains), fruitfulness (suggesting new experiments, hypotheses or methodological approaches), consistency (with other accepted theories) and one we have already come across, intervention (the desire to intervene upon causal chains such as to produce a desired effect). All these interests might motivate one to pursue, construct and/or accept explanations.

Table 1
A preliminary taxonomy of (cases of) multiple inter-level explanations.

	Different descriptions of one cause	Different descriptions of two distinct causes
Relevant causal factors	Integration, reduction, elimination, independence	Independence, integration
Productive sufficient causes	Integration, reduction, elimination, independence	Elimination, causal overdetermination

5.2. Mill on proximity of causes

The second pragmatic factor is the *proximity* of a cause relative to the effect. In a nutshell, a cause is proximate if it is directly linked with its effect; remote if it is linked indirectly via some other cause—the more causes in between the original cause and the effect, the more remote it is. Thus, if Billy throws a baseball that shatters the window, then Billy throwing the baseball is a proximate cause of the window shattering; if in turn the shattering of the window startles Suzy, then we can say that Billy throwing the baseball is a remote cause of Suzy being startled. Whether some event is a proximate or remote cause of another event then, is determined by whether the causal link is mediated or not. I borrow the notions of remote and proximate causes from J. S. Mill, who illustrates them as follows:

> …mankind were aware that the act of touching an outward object caused a sensation. It was subsequently discovered that after we have touched the object, and before we experience the sensation, some change takes place in a kind of thread called a nerve, which extends from our outward organs to the brain. Touching the object, therefore, is only the remote cause of our sensation; that is, not the cause, properly speaking, but the cause of the cause (…) Future experience may not only give us more knowledge than we now have of the particular nature of this change, but may also interpolate another link (…). Hitherto, however, no such intermediate link has been discovered; and the touch of the object must be considered, provisionally, as the proximate cause of the affection of the nerve (1882 pp. 575–576).

Besides introducing the concept of remote and proximate causes, this quote also illustrates two further points. First of all, it shows that this factor is indeed pragmatic: what cause counts as the proximate is dependent upon scientific progress. Upon investigation, it may turn out that the cause we identified is in fact more remote than we originally thought—indeed, regarding Mill's example of the nerves mediating between touching an outward object and the occurrence of a sensation, scientists have discovered many additional mediating causes. Second, it also shows that these concepts are useful in the context of inter-level explanations. To be sure, the explanation Mill cites is inter-level according to the terms set in the introduction, as it refers to entities and processes at different levels of description, from behavioral (touching) to psychological (sensation) and physiological (nerves).

There are two things to note before we move on. First, the proximity-distance distinction does not track the relevance-productive distinction. In Mill's example, the causal chain relates touching an object, changes in the nerve, and the sensation of touching the object: all of these, the proximate as well as the remote, are productive causes bringing about the next link in the chain. Yet if we return to the patient genetically prone to developing depression, who develops it after learning of the death of a

[9] Of course, there are also non-epistemic interests, i.e. goals that do not obviously concern the scientific method (e.g. social, ethical or political goals), and the distinction between epistemic and non-epistemic may not always be clear cut (cf. Lacey, 2004).

[10] There might be theorists who insist that understanding is never a goal in itself, but is always sought relative to some more practical purpose like control or intervention. Here, I side with Kitcher when he says that "Surely the principles of thermodynamics would be worth knowing whether or not they helped us to build pumps and engines" (2001: 65). In any case, though the relations between different epistemic interests are an issue worth exploring, nothing much in this article depends on the outcome of such an enquiry.

relative, then although we are dealing with relevant causal factors, one may still sensibly talk about a difference in proximity between these factors. Second, for obvious reasons the proximity-distance distinction only applies to the right column of the table presented in Section 4: only when two explanations cite distinct causes does it make sense to ask which of them is the proximate one.

6. Combining epistemic interests and proximity of causes into heuristic guidelines

How do epistemic interests and proximity of causes bear upon the issue of grain size? One reason someone might choose to emphasize the most proximate cause is that it allows for more reliable interventions. Again, this was already recognized by Mill:

> Thus, in our former example, the law that the contact of an object causes a change in the state of the nerve, is more general than the law that contact with an object causes sensation, since, for aught we know, the change in the nerve may equally take place when, from a counteracting cause, as, for instance, strong mental excitement, the sensation does not follow […] Not only are the laws of more immediate sequence into which the law of a remote sequence is resolved, laws of greater generality than that law is, but (…) they are more to be relied on; there are fewer chances of their being ultimately found not to be universally true (1882, book III, Ch. 12, §4, pp. 577–578).

Mill employs the notions of laws, generality, and reliability, but the same point has been made many times over in the literature, using different concepts. It can be stated in terms of ceteris paribus conditions, counterfactual support, invariance under change, or in terms of process versus program explanations (Jackson & Pettit, 1990). The point is that if our epistemic interest is intervention, i.e. if we want to intervene upon a causal change so as to reliably produce a (desired) effect, we had better focus on the explanation citing the proximate cause. Here, we must grasp the bottle by the neck, so to speak.

Although I agree with Mill's diagnosis, it would be mistaken to conclude that proximate causes are *always* better, as some authors have argued (e.g. Elster, 1983 p. 28). Here are a couple of situations in which the remote cause has something to offer that the proximate does not.

One interest which is sometimes better served by the explanation citing the remote cause is prevention: the desire to intervene upon a particular causal chain with an eye to preventing a certain outcome. Of course, since the interest of prevention is a special case of the interest of intervention, often we want to intervene upon the proximate cause. However, an advantage of the remote cause is that it allows a greater window of opportunity in which to act. This is particularly important in situations where the intervention-procedure takes a lot of time to implement, or when it is technically complex or expensive. Suppose we try to prevent an earthquake resulting in a massive death toll. Predicting the earthquake by means of measuring a more proximate cause may be more reliable, but the resulting prediction may come too late to implement the lengthy process of mass evacuation. Or suppose we know that outbreaks of a certain tropical disease are caused by a viral infection, which in turn is caused by mosquito bites. Administering preventative antibiotics would presumably yield a higher success rate than handing out mosquito nets, since, as Mill observes, the former undercuts any other (perhaps still unknown) cause of infection, but antibiotics may be too expensive to produce on a large scale, or too difficult to distribute widely. In short, the greater window of opportunity offered by the remote cause may trump the reliability offered by the proximate cause.

Sometimes, the explanation citing the proximate cause is not only inferior, but altogether useless. This can happen when attempting to understanding *contrasts*. To return to the example of the viral infection: suppose that two populations A and B are normally hit with an epidemic during the summer (when the mosquitoes are most active), but that one summer, A remains healthy, while B is hit with an epidemic as usual. If we want to understand this contrast between A and B, citing the proximate cause does not constitute an adequate explanation. That is, one cannot understand why A remains healthy while B does not by stating that in A there were no viral infections, while in B there were: here, the explanans is equally mysterious as the explanandum. Rather, an explanation citing a more distant cause, such as the distribution of mosquito nets in A and not in B, is explanatorily superior, because in contrast to the explanation citing the proximate cause, it allows us to understand the contrastive explanandum.[11]

It is important to note here that all this is compatible with standard explanatory pluralism: because our interests vary, there are no general exclusion or preference rules with respect to remote or proximate causes. Sometimes, we want only the proximate cause, sometimes we want only the remote one, sometimes, we want a combination of the two. The point is that a careful scrutiny of the epistemic interests involved can help us understand why scientists choose to explain by referring to a more proximate or more remote cause. Thus, rather than simply asserting that pragmatic factors influence the choice of explanatory level, or in this case, the decision to put the emphasis on one level rather than another, we have made a start with *identifying* those pragmatic factors. In effect, the present discussion allows us to formulate three prescriptive guidelines that can be used to decide on which explanation to focus:

A) If your interest is reliable intervention, focus on the explanation citing the proximate cause.
B) If your interest is prevention, focus on the explanation citing a cause distant enough to allow for timely predictions.
C) If your interest is to understand a contrast between two states of affairs, focus on an explanation citing a cause distant enough to be less mysterious than the explanandum.

Four characteristics of these rules should be noted. First, as I have already said, they apply only to cases in which two explanations cite two distinct causes (whether productive or relevant factors), otherwise it makes no sense to talk about more distant or proximate causes. Second, they are guidelines, i.e. heuristic tools, or research strategies, that are meant to help scientists decide what type of explanation to emphasize or pursue. As such, they are rules of thumb, not mandatory principles. Third, although I have formulated these guidelines prescriptively, they can also be used descriptively (to make sense of the explanatory practice of scientists) and normatively (to evaluate the appropriateness of given explanations). Finally, there is a sense in which proximity is a default virtue. That is, by reflecting on these rules, although one can appreciate that certain specific circumstances may lead one to prefer an explanation citing a more distant cause, nevertheless, other things being equal, proximity is usually better. For example, when considering rule B, if in a given case the most proximate cause *does* allow for a wide enough window of opportunity, then of course this makes the explanation citing that cause superior, as it serves both the interests of prevention *and* reliability.

[11] Van Bouwel and Weber (2002) have made similar points regarding the usefulness of remote causes in the context of the social sciences.

In any case, the points developed so far are still neutral with regard to the issue of inter-level explanation. Although, as we have gleaned from Mill's example of touch and sensation, this conceptual apparatus is potentially useful for understanding inter-level explanations, this has yet to be demonstrated. To do this, we need to apply the guidelines to an example of actual inter-level explanation.

7. Applying the guidelines: the case of Korsakoff syndrome

Korsakoff syndrome is a memory disorder, the symptoms of which include anterograde amnesia (the impairment of the function to create new memories), retrograde amnesia (the impairment of the function to recall events prior to the onset of the disease), and confabulation (invention of false memories). A strongly related disorder is Wernicke's encephalopathy, a potentially lethal disease which has the following 'classic' symptoms: oculomotor abnormalities, ataxia, and global confusion (Wernicke, 1881). Wernicke's encephalopathy so often accompanies Korsakoff (and is thus a reliable predictor), that it is thought to have the same pathological substrate, the idea being that Korsakoff is simply a worse clinical manifestation of the same, underlying disease, so that researchers often speak of the Wernicke–Korsakoff complex (Harper, Giles, & Finlay-Jones, 1986). This association is strengthened by the fact that both conditions are caused by thiamine (vitamin B1) deficiency (Harper, 1979; Wood & Breen, 1980).

But what causes this thiamine deficiency? In the western world, the most frequent cause is alcohol abuse (Truswell & Apeagyei, 1982; Victor & Laureno, 1978; Wilkinson, 1975). Alcohol abuse often leads to a poor diet, which causes thiamine deficiency in the long run. In any case, we now have the following causal chain: alcoholism → thiamine deficiency → Wernicke–Korsakoff complex. Here, alcoholism is a distant cause, and thiamine deficiency a more proximate cause. Although these causal links are well established in the scientific literature, we should remember Mill's lesson: further study may identify yet more causes in between thiamine deficiency and Wernicke–Korsakoff complex. Of importance also is the fact that the chain is inter-level, in the sense defined in the introduction: it starts with a psychologically defined explanandum (Korsakoff; i.e. memory impairment), cites a proximate cause on the biochemical level (thiamine deficiency) and a distal cause at the behavioral level (alcoholism). Note that, as alcohol abuse is a relevant causal factor in developing thiamine deficiency, which in turn is a relevant causal factor in developing Korsakoff syndrome, as it stands the relation between the explanations of Korsakoff syndrome citing these respective causes constitutes an example of independence in terms of the table presented in Section 4: the descriptions cannot be reduced to each other; nor can one of them be eliminated, since they are grounded in the causal structure of the world (alcoholism and thiamine deficiency are not just two terms for the same cause). They can be integrated or combined into a compound explanation. This compound explanation may well apply to fewer cases, as thiamine deficiency can also be brought on by other factors besides alcohol abuse. Nevertheless, within the constraints posed by these non-pragmatic factors, given our pragmatic purposes, positive recommendations concerning the appropriate explanatory level can be made. To see this, let us apply the three prescriptive guidelines developed in the previous section. Recall the first rule:

A) If your interest is reliable intervention, focus on the explanation citing the proximate cause.

In this case, to intervene reliably means to administer thiamine, either through intravenous or intramuscular injection in cases of acute attacks of Wernicke's encephalopathy (Agabio, 2005), or by means of adding thiamine supplements to basic food stocks in the case of the more long-term development of Korsakoff syndrome (Yellowlees, 1986). This is a more reliable procedure than treating a patient for his or her alcoholism, since there are other causes for a thiamine deficiency besides alcoholism (e.g. eating disorders).

Here, we can see how unpacking preferences of grain sizes in terms of interests and proximity of causes works: which level to emphasize is now no longer determined by a supposedly privileged status of lower-or higher levels, nor is it determined solely by the pragmatic factors at work. Rather, pragmatic and non-pragmatic factors work together to direct our explanatory attention to a particular level. Within the constraints posed by the fact that both explanations cite distinct causes, the choice to focus on the lower level is indeed pragmatic. The interest of reliable intervention calls for a manipulation of the proximate cause, and in the case at hand the proximate cause happens to reside at a lower level.

Now consider the second rule:

B) If your interest is prevention, focus on the explanation citing a cause distant enough to allow for timely predictions.

It stands to reason that if we want to prevent Korsakoff from developing later in life, than we should actively try to change habits of young people: thus, the intervention will be at the behavioral (e.g. psychotherapeutic) level. Here, one chooses the explanation citing the remote cause, since it allows for a timely prediction. If alcohol abuse is a good indicator for the development of Korsakoff later in life, then it is worthwhile to try to reach children at a young age. The fact that this explanation is less reliable than one citing the proximate cause (since we will not reach people who develop a thiamine deficiency through some other condition such as anorexia), is trumped by the window of opportunity it allows. As with the first rule, the epistemic interest influences the choice we make. Prevention calls for a more distant cause, and the fact of the matter is that in this case, the suitably distant cause is located at the behavioral level.

Finally, recall the third rule:

C) If your interest is to understand a contrast between two states of affairs, focus on an explanation citing a cause distant enough to be less mysterious than the explanandum.

If we are interested in explaining the difference between two populations, one of which does have a significant number of members who develop Korsakoff later in life, and one in which there are far fewer cases reported, then explaining this contrast by means of the proximate cause does little to alleviate the sense of mystery one has about the explanandum. It would not be very helpful to explain the difference between the two populations by stating that the first has more cases of thiamine deficiency than the other. This would be simply to re-describe the explanandum. Rather, one might look at differences in life style between the populations.

There is, however, one specific set of circumstances in which including the proximate cause is helpful to explain contrasts, namely when the difference between the two groups contrasted in the explanandum is not repeated at the level of that cause. For example, it has been found that France, although it has one of the highest alcohol consumptions per capita, reports far fewer cases of Wernicke–Korsakoff syndrome than do more 'dry' countries, leading researchers to hypothesize that French people get more thiamine from their specific diet, canceling out (and indeed, surpassing) any negative consequences of their alcohol consumption (Harper, Fornes, Duyckaerts, Lecomte, & Hauw, 1995). Here, the

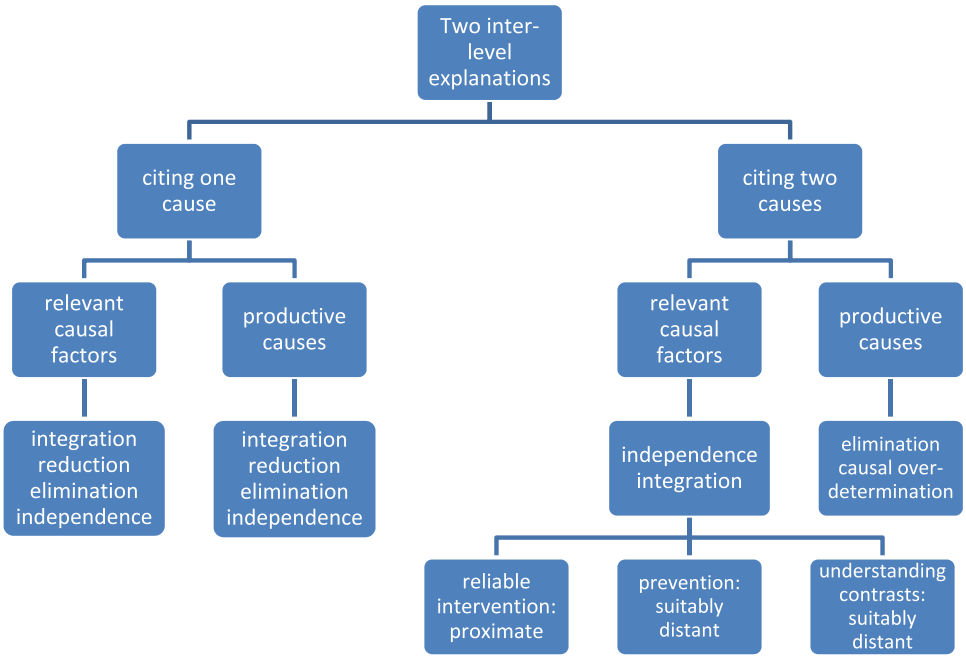

Fig. 1. Framework for deciding between inter-level explanations.

proximate cause is cited, but not as an explanans: the fact that the difference between French people and other nationalities that manifests itself on the level of the explanandum (the development of Korsakoff), is not mirrored in their respective levels of thiamine despite their alcohol consumption, only adds to the mystery. Properly speaking, the proximate cause here is not an explanans but an explanandum.

8. A framework for understanding inter-level explanation

We are now in a position to explicate a framework for studying inter-level explanations. When confronted with a choice between two inter-level explanations, or between emphasizing one or another part of a compound explanation, the framework presented in Fig. 1 may help one decide.

As one can see, the second tier distinguishes between cases of two inter-level explanations citing one or two causes, the third between relevant causal factors and productive causes. The domain of inter-explanatory relations is presented in the fourth tier. In the conclusion, I will consider some ways in which this framework can be expanded. First however, let us briefly compare it to standard explanatory pluralism.

If we recall the four claims presented in Section 2, then it is easy to see that this framework stays true to the spirit of standard explanatory pluralism: it affirms that there are no general preference or exclusion rules with respect to explanatory levels, and it is compatible with the idea that having explanations on multiple levels can be beneficial to scientific progress. Indeed, both diachronic and synchronic relations between explanations are accommodated within the framework. As we have seen in the case of two inter-level explanations citing two distinct relevant causal factors, this new explanatory pluralism is quite happy for two such explanations to co-exist: it only offers guidelines to help us decide on which of the two to focus given our interests.

Only the fourth claim, that the choice between levels of explanation is decided by pragmatic factors, has been shown to apply more locally than the literature on explanatory pluralism has hitherto suggested. When multiple inter-level explanations target the same explanandum, then before pragmatic factors can come into play, two non-pragmatic issues need to be settled first. Are the explanations descriptions of one, underlying causal process, or are they referring to distinct causal processes? Are the causes referred to relevant causal factors, or are they productive causes?

If answering the first question takes you to the left branch on the second tier, then it does seem that the way is open for purely pragmatic factors to guide your choice of level. If it takes you to the right branch, then answering the second question is also of importance. Even so, within these non-pragmatic constraints, pragmatic factors play a decisive role. As we have seen, this does not mean that anything goes: it is possible to formulate guidelines like the ones presented in Section 6, to make sense of and evaluate the choices made by scientist, and to guide choices that are yet to be made. Thus, in contrast to standard explanatory pluralism, the framework I have presented here suggest a more subtle story about inter-level explanations: the choice of or emphasis on explanatory levels is ultimately grounded in the dynamic interplay between pragmatic and non-pragmatic factors.

9. Conclusion

Admittedly, the framework presented in this article is very general, and as I have said in the introduction, its character should be interpreted as programmatic. Ultimately, its strength (how much of an improvement it is over standard explanatory pluralism) depends on the degree to which it can be further developed. In particular, rules to decide between two inter-level explanations citing one cause (both causally relevant factors and productive causes) would be a welcome addition. Furthermore, the previous sections only gave us a flavor of what is possible in cases of two inter-level explanations citing two distinct relevant causal factors. Many more guidelines may be developed besides the three listed here. Of particular importance here would be the inclusion of new epistemic interests, and the application of the framework to more, and more diverse, scientific domains. Thus, the framework suggests some concrete ways to construct at a new, more nuanced, type of explanatory pluralism.

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