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Explaining Understanding

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9 An Evidentialist Account of Explanatory Understanding

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1 INTRODUCTION

In this chapter, I build a theory of explanatory understanding using Evidentialism as my epistemology. This may not initially seem like a promising endeavor for two reasons. First, Evidentialism is a theory of knowledge which entails a propositional account of understanding, and many philosophers think understanding is quite different from knowledge. For instance, as Jonathan Kvanvig points out, what comes to mind when we think about knowledge are issues about evidence, reliability, reasons for belief, and anti-luck conditions; whereas when we think about understanding, it is our grasp of logical, probabilistic, or explanatory relationships that come to mind (Kvanvig 2009, 97). There is surely something right in this. For instance, understanding a theory like classical mechanics requires the appreciation of a host of structural relationships (mostly between equations) which allow one to solve physics problems, and this seems to go far beyond merely knowing what the theory says. Second, Evidentialism, at least in its most popular form, appeals to an explicit explanatory decision-making process: inference to the best explanation (IBE). But IBE has serious problems of its own. Perhaps the most serious criticisms have come in the form of underdetermination arguments, suggesting there are always alternative explanations from those we consider the best, no matter how compelling our evidence. To the extent that Evidentialism adopts IBE it may be subject to similar attacks.

Despite these obstacles I believe a plausible account of understanding can be given using Evidentialism. I do not claim this is the only available account of explanatory understanding, I simply aim to give Evidentialism a run for its money by trying to build a cogent account on its basis. I will argue that by distinguishing carefully between the abilities necessary for someone to understand an explanation in a deep sense and merely possessing a shallow linguistic understanding of it, we can address the gap between knowledge and understanding to which Kvanvig points. The more demanding sense of explanatory understanding requires significant

inferential abilities which go far beyond merely understanding what the explanation says. This can be achieved quite clearly under an Evidentialist approach. We can also avoid the problems associated with IBE by rejecting that method of inference outright, instead adopting a default reasoning form of evidentialism.

In what follows I first introduce the epistemic theory of Evidentialism as advanced by Earl Conee and Richard Feldman, then I develop their view into an account of explanatory understanding. I'll show that several serious problems arise for this preliminary account, but that if we further develop the view by subsuming it under an inferentialist model of understanding, these problems can be handled, leaving a much more coherent and perhaps even convincing account of explanatory understanding. Specifically, I will use two moves when implementing my inferentialism: (i) reject propositionalism and intellectualism regarding understanding, and (ii) reject inference to the best explanation, instead adopting a default reasoning epistemology. These two strategies could perhaps be adopted without inferentialism, but I leave that possibility to one side for this essay.

2 A SUMMARY OF EVIDENTIALISM

In their 2004 book *Evidentialism*, Conee and Feldman lay out the main tenets of their position. For them, as for many nowadays, knowledge is justified true belief with an anti-luck condition to rule out Gettier-type cases. The driving idea behind an Evidentialist account of knowledge is that epistemic justification is determined by one's evidence (Conee and Feldman 2004, 83):

(EJ) Doxastic attitude D toward proposition p is epistemically justified for S at t if and only if having D toward p fits the evidence S has at t .

Furthermore, if S believes p for the wrong reasons, then something has gone wrong with S 's belief-adoption. So Evidentialism emphasizes the need for S to base her belief on evidence e in the right way – to ensure it is well founded (Conee and Feldman 2004, 93). To be well founded (WF) S 's belief must be justified, S must have evidence for it, and there must be no more evidence held by S , which would undermine that belief.

Additionally, in a recent paper Conee and Feldman (2008) have clarified three important points about Evidentialism: (i) evidence ultimately boils down to immediate experience, (ii) “possessing evidence” can be treated as possessing the relevant mental state – although perhaps lacking

immediate access to it, and (iii) a proposition is justified if it is part of the best explanation available to the subject for their experiences. Thus, Evidentialism is a mentalist (rather than accessibilist) and internalist epistemology which takes evidence as providing experiential reasons that justify our beliefs through inference to the best explanation.

3 WHAT WOULD EVIDENTIALISM LOOK LIKE AS A THEORY OF UNDERSTANDING?

According to Conee and Feldman, understanding is just having explanatory knowledge:

Understanding why some fact obtains ... seems to us to be knowing propositions that state an explanation of the fact.

(Conee and Feldman 2011, 316)

Given this statement, it might be appropriate to articulate Evidentialist understanding as:

(EU) S understands why some fact f obtains if and only if S knows an explanation e of f .¹

If knowing is achieved according to the Evidentialist criteria, then understanding must be a belief state that satisfies well-foundedness; the object of knowledge is a set of propositions that constitute an explanation of some fact; and that explanation must be available to S. On this account there is nothing unusual about understanding some fact. It is just another case of propositional knowledge. The following examples illustrate the initial plausibility of EU.

Titanic: Take $f_{titanic}$ to be the fact that the Titanic sank. One explanation of $f_{titanic}$ is explanation $e_{titanic}$: The Titanic hit an iceberg, and although the hull's steel plates were adequate for bending under the impact, the rivets holding them together were not. The rivet heads popped off leaving the bulkheads to split along rivet lines. As a result, six of the Titanic's interior compartments were flooded, which was more than its sustainable limit of four.

According to Evidentialism, S understands $f_{titanic}$ because S knows $e_{titanic}$. EU can also accommodate scientific explanations:

Muons: Take f_{muon} to be the following: muons, which have a proper lifetime of only 2.2×10^{-6} seconds, can last the longer travel time of

333×10^{-6} seconds as they traverse from the upper atmosphere to the earth's surface. How is this possible?

Explanation e_{muon} : muons are elementary particles which travel at 0.999978 times the speed of light. Entities that travel this fast are subject to the time dilation effect of Special Relativity. Time dilation is given by the relation: $\Delta t = \Delta t_0 / \sqrt{1 - (u^2/c^2)}$. Where Δt is change in time in Earth's reference frame, Δt_0 is change in the proper time of the muon, u is the muon's speed and c is the speed of light. Doing the calculations we find that although it initially seems impossible, muons can actually last long enough to survive the journey.

In this explanation, almost all the explanatory work is being done by the notions of a reference frame, the concept of proper time, and the time dilation equation. According to EU, all S need accomplish in order to understand f_{muon} is to know e_{muon} in the sense explained above.

But here is our first problem: Muons is substantially unlike Titanic since it provides a conceptually challenging explanation. It seems wrong for EU to so simple-mindedly suggest S really understands f_{muon} if knowing e_{muon} requires only the satisfaction of EJ and WF. After all, one can justifiably believe e_{muon} yet not really have a clue what is going on because despite having linguistic understanding of the sentences in the explanation, one really doesn't have deep *conceptual* knowledge about what a reference frame is, or what proper time implies. If this were the case, one clearly wouldn't really understand f_{muon} . The novice has only a superficial linguistic understanding of the explanation but is lacking the conceptual resources to appreciate the deep meaning of the sentences.²

Feldman gives us a clue for how to address this concern in his handling of a similar problem that arises for expert knowledge. In the context of explaining what it is to possess evidence, Feldman (Conee and Feldman 2004, 239) argues that what distinguishes an expert bird-watcher from a novice is the ability to draw on non-conscious beliefs about birds in order to make accurate categorizations. A novice has no such repertoire of background beliefs, and so fails to be justified in her (perhaps accurate) diagnosis that what they both observe is a scarlet tanager.

We can adapt this idea to solve our problem with explanatory knowledge and understanding. The thought is that in Muons a novice really doesn't understand the explanation because he has too shallow a grasp of its central concepts. An expert on the other hand has a robust set of background beliefs about things like reference frames, and the means of determining and measuring proper time. These enable the expert to make sense of the explanation, a lot like the expert bird-watcher who makes sense of what she is seeing by being able to categorize it on the basis

of background beliefs. Evidentialism should therefore receive an amendment which includes these dispositional beliefs as part of what constitutes knowledge:

(BB) If *S* knows *p* then *S* possesses background beliefs that enable *S* to categorize the content of *p*.

One might object that having relevant background beliefs is not sufficient for correctly informing our inferences; we have to *use* them in the right way as well. After all, an expert might be capable of reliably identifying a scarlet tanager via internalized rules, but on the occasion that it is a mere guess we would judge her unjustified in her belief. This is the question of how an agent must satisfy an appropriate “basing relation.”³

An initial response is to point to Feldman’s description above of how an expert comes to internalize those background beliefs: one doesn’t move from explicit learning (novice) to implicit categorization (expert) without a track record of successful categorizing. Consequently, the expert has background evidence of success at correctly recognizing birds which plays a role in her reinforcement of the internalized rules. This idea ties in nicely with another point Feldman makes when talking about the expert’s access to evidence:

The expert may have feelings of certainty about her identification that help justify her belief ... if she lacks the feeling of certainty and her belief seems to her to be just a guess or a hunch, then it is far from clear that the belief is current-state justified.

(Conee and Feldman 2004, 239)

Although it is possible for a novice to suffer over-confidence (and an expert under-confidence), this point from Feldman can be used to explain my suggestion above: an expert may have confidence if she rationally judges her evidence for successful categorization. Past success is evidence, so there is justification for this confidence. This sort of confidence goes hand in hand with a concept associated with availability of evidence: *seemings*. In his “First Things First” (Conee and Feldman 2004), Conee suggests that perhaps one plausible option is to take availability to amount to reasons *seeming* true. He calls this “seeming evidentialism.” On this approach, since the apparent truth of an explanation strikes us as correct without explicit evaluative work, it is a seeming. This makes the seeming that an explanation is the best explanation evidence for that explanation.⁴

This line of thought suggests a further amendment to EU. Just as WF provides a guarantee against having supporting evidence but not using it

appropriately, EU also requires a constraint that provides a “correct use” clause. We can simply add to BB:

(BB*) If *S* knows *p* then *S* possesses *and appropriately uses* background beliefs that enable *S* to categorize the content of *p* in a way that *seems* to *S* to provide the best explanation of the evidence.

With this addition, we can still characterize evidential understanding with EU, being mindful of the need for BB* to be included in the account of knowledge, along with EJ and WF.

4 PROBLEMS WITH EU

Although we’ve made some progress on evidential understanding, the account given by EU cannot be correct. I see four problems for this approach, the first two will apply to any account which treats understanding as reducible to propositional knowledge; the latter two will apply to any account appealing to an explicit explanatory evaluation mechanism.

- 1 *Knowledge is not necessary for understanding (Gettier Case)*: Imagine that Bob and Bob* are both students in a course on modern physics. They each have the same true beliefs about how a muon can survive its descent from the upper atmosphere. Bob learned the explanation from a trustworthy textbook. Since his beliefs are true and are non-accidentally well founded, Bob has knowledge according to Evidentialism. Bob* on the other hand, has all the same beliefs, but he learned his explanation from a completely unreliable text written by a prankster. The only correct explanation in this book is the one about muons. Bob* has reason to think the account correct, but it is only accidentally identical to the one in Bob’s textbook. Bob* has well-founded true beliefs, but lacks knowledge according to Evidentialism. EU would judge Bob to have understanding of why a muon can make it to earth, but judge Bob* to lack understanding. To some philosophers this is the correct result. They think understanding is incompatible with standard Gettier-style cases because it seems counterintuitive to them to say we can understand something if the source of our beliefs is somehow compromised. However, here I’d like to appeal to Kvanvig’s insight at the beginning of this chapter. When we think about understanding, our mind is drawn to issues such as our grasp of logical, probabilistic, or explanatory relationships. We are not so much concerned with concepts like justification or anti-luck conditions. This seems correct, for when we ask whether someone

understands why my car won't start, notions of justification fade into the background. What we care about is whether their set of beliefs constitute a correct explanation or not. Similarly, because both Bob and Bob* have the same mental states, and thus the same explanation cognitively available, it seems they both equally understand, though only one of them knows. This indicates, contrary to EU, that knowledge is not necessary for understanding.

- 2 *Knowledge is not sufficient for understanding*: Bill is also attending Bob's modern physics class. Bill does better than Bob* with the central concepts in the explanation, like "reference frame" and "proper time." He is able to categorize these concepts appropriately by using background beliefs, and can in general make sense of the sentences in which they appear. He therefore has quite detailed linguistic understanding and satisfies (BB*), something Bob* fails to do. But that is about it. That is, Bill can interpret the meaning of each sentence in the explanation because he knows the definitions of the concepts involved, but he does not know how to use further properties of these concepts. For instance, he knows that an inertial reference frame is defined as one in which Newton's laws hold, but he doesn't know how that contrasts with any other reference frame. He knows that proper time is measured by an observer according to whom the beginning of the time interval and the end of the time interval occur at the same location, but has never considered what it would mean for someone to measure the interval from different locations. He knows the basic mathematical properties of square roots, exponents, and the procedure of division and subtraction, but he couldn't derive the relativistic equation from its predecessor equations. So, even with all his background knowledge, there is still something lacking in his achievement. He doesn't know much more than the definitions that arise in the explanation, and that might convince us he doesn't really understand f_{muon} .

Let's think about this issue specifically as it pertains to Evidentialism. If we take seriously Feldman's bird watcher argument for categorization skills as necessary for knowledge, then we have to find an analog to categorization in the e_{muon} example. Let's say Bill knows what the propositions mean because he can interpret them. Since the explanation is really just a conjunction of propositions, we can conclude Bill knows the explanation if he can interpret the meaning of its propositions (as well as satisfy Evidentialist requirements EJ, WF, and BB*). However, interpreting the meaning of an explanation's propositions, what we might call "linguistic understanding" and understanding the explanation in its entirety, what we might call "explanatory understanding," are not the same thing. The former

seems only to entail that one understands the meaning of words and comprehends how they are constructed into a proposition. The latter suggests more than this – perhaps entailing further abilities like being able to recognize the physical principles underlying a theory and seeing how they generate relations involved in an explanation. This sort of thing seems to be in play when we understand Titanic or Muons. In Muons we see clearly the necessity of recognizing such underlying principles. However, Titanic might not appear to require so much from us. But our two examples are different in complexity only, not in kind. Even in Titanic, if you didn't understand physical principles like "action-reaction," "elasticity," and "buoyancy," one would be at a loss to understand the explanation in the more demanding sense.⁵ That doesn't mean one couldn't understand the sentences. For instance:

- i "The rivet heads popped off leaving the bulkheads to split along rivet lines."
- ii "Six of the Titanic's interior compartments were flooded."

One can grasp the meaning of these sentences without grasping that the impact *generated* the force which *caused* the bulkhead plates to separate from their seams, and that this separation itself *generated* openings for water to gush into the inner compartments of the hull. So it seems intuitively plausible that understanding an explanation is more than just knowing what it means. Maybe this just shows Feldman is wrong and that categorization shouldn't be equated with linguistic understanding. Maybe we should demand more of a knower. Perhaps categorization's analog in explanation really is closer to the ability to know how underlying principles explain the relations which appear in an explanation. This would for instance suggest that one only understands *emuon* if one also knows how the constancy of the speed of light in all inertial reference frames contributes to time dilation.

This cannot be right, though. For if we assume that to know a proposition one has to be able to apply underlying physical principles, we end up with an implausible demand on knowledge. For instance, knowing how physical principles contribute to categorizing a bird, one would have to understand the physical basis of its field markings. Presumably this would amount to something like knowing the biological origins of these markings – perhaps an evolutionary story. Surely to require a knower have working knowledge of these additional explanatory relations is to risk a regress. For this would entail underlying physical principles can only be known if we have knowledge of further principles underlying that first set of principles. And

the problem would repeat for each new set of principles, running us into an infinite regress. This would be too much to ask of any knower.

The upshot is that with a plausible account of knowledge, one that doesn't require great depth of background beliefs, EU fails to secure explanatory understanding. On the other hand, including deep background beliefs entails a regress. This shows knowledge alone is not sufficient for understanding.

- 3 *Over-intellectualizing*: EU uses the notion of "best explanation" in virtue of its use constraint (BB*): *S* is justified only if *S* adopts the belief which is part of the best explanation of the evidence *S* has available. For Feldman at least, this means that the best explanation *seems* to *S* to be the best explanation. This further suggests that in order to understand an explanation *S* must *actually be going through the process of evaluating* the best explanation.⁶ If so, then *S* is comparing an explanation *e* against other possibilities, and hence is using evaluative skills to determine which is best.⁷ If this is EU's claim, it is surely over-intellectualizing explanatory knowledge. It is far too demanding to require that *S* performs an inference to the best explanation for every explanation she understands.

One obvious route to evade this charge is to opt for a cognitively less demanding condition. McCain (2014) has suggested instead of an explanation for some proposition seeming to *S* to be the best, *S* only be *disposed* to reflect and have a seeming that it be the best. This move would soften the cognitive demands on *S* so as to evade the over-intellectualizing charge.

However, even with this move, *S* would still be required to possess the disposition to evaluate explanations, and this comparative ability seems much too demanding for explanatory understanding. For example, intuitively one does not need to be disposed to evaluate alternative explanations in order to understand the sinking of the Titanic. For instance, one need not be able to consider whether the decision to reverse-thrust the engines resulted in a failure to steer away from the iceberg, or whether it was the absence of binoculars in the crew's nest which was to blame, or if it was the captain's recklessly speeding through a known ice field at twenty-two knots. One need not be able to consider any such possibilities in order to grasp the explanation *e_{titanic}* given above.

- 4 *Circularity*: Even if EU can hold on to the criterion of evaluating explanations, it runs the risk of vicious circularity. After all, as we saw in the previous objection, *S* must compare *e* against other potential explanations. But how is *S* to do this without already understanding *e*? One cannot perform an inference to the best explanation without

already having explanatory understanding of the explanations being compared.

It is no good trying to wriggle out of this problem by appealing to the thin notion of “linguistic understanding,” claiming all one needs to perform an inference to the best explanation is a basic comprehension of the meaning of the propositions involved. That would result in *S* evaluating explanations without grasping how their relational properties generate explanatory narratives – like trying to evaluate which is the best of several novels by understanding only what they each literally say, not what themes and messages are being conveyed implicitly by the authors. Evaluation of explanations surely requires explanatory, not mere linguistic, understanding, something EU cannot provide without circularity.

5 IMU

I find the above criticisms quite devastating, but also believe an adequate account of explanatory understanding can be recovered from EU while still retaining its benefits. To do this, I will turn to an account of understanding for which I have argued elsewhere.⁸ The model is called the “Inferential Model of Understanding” (IMU), and it is really a template for *kinds* of understanding. It has no commitment to one specific epistemology or another, though some of its claims for each kind of understanding will limit which epistemologies can be inserted and where.⁹ In what follows I consider how to fix some of EU’s problems by inserting Evidentialism into the IMU model. IMU can be summarized by its characterization of the following concepts:

- (K) Knowledge of an explanation is an accurate, justified representation of the explanation’s propositional content.
- (U) Understanding an explanation is achieved when the representation of an explanation’s propositional content is internally connected by correct inferences.
- (UT) *S* understands scientific theory *T* iff *S* can reliably use principles *P_n* constitutive of *T* to make goal-conducive inferences for each step in a problem-solving cycle, which reliably results in solutions to qualitative problems relevant to that theory.

A few comments are in order to explain these definitions. First, IMU as an overarching framework is a naturalistic approach that attempts to provide a substantive and constitutive account of different kinds of understanding. It treats our beliefs as forming a cognitive hierarchy with

representational content cashed-out as rules. For instance, seeing a cat activates a set of rules, which together constitute the concept “cat.” This “rules-as-concepts” idea is adopted from mental models work in cognitive psychology. On this approach a mental model is a mental representation used to model the properties, relations, and processes of the things we perceive. If we see a cat leaping to catch a feather, our minds construct a mental model of the event by activating sets of rules which constitute a cognitive hierarchy. Rules are therefore the basic building blocks of all representations. These rules (concepts) are usually activated by default expectations which are taken by us to be correct until contradicted by evidence. For instance, we assume what we see is a cat, until further evidence contradicts this assumption. This sort of reasoning is known as “default reasoning.” It is the sort of implicit inferential work that dominates much of our everyday reasoning.

The driving idea is that we are justified in drawing a conclusion by default if we have no information which would make us doubt that the inference should be drawn – such as evidence that we are dealing with an exception to the rule. When we have a perceptual experience we activate a default hierarchy of rules which constitute a primitive mental model. The hierarchy undergoes updating of rule-structure and rule-strength with time-step execution cycles – learning. When the system does encounter unexpected input data, it switches to more “deliberative reasoning.” This involves the sort of reasoning that takes place when one’s default reasoning is challenged by evidence of exceptions, and is usually explicit and of a problem-solving nature. Second, aside from conditions required for knowledge (which will differ from one epistemology to another), I term the kind of understanding a subject achieves with (K) “linguistic understanding.” This reflects the subject’s ability to represent an explanation in a way which reflects conceptual grasping of the meaning of each proposition involved.

In contrast, (U) is the kind of understanding we have when we understand an explanation, what I call “explanatory understanding.”¹⁰ Lastly, (UT) is “theoretical understanding” – the kind of understanding one has of a theory. In sequence from (K) to (UT), achieving these forms of understanding puts increasingly heavy demands on our cognitive abilities.

Third, the primary difference between (K) and (U) is that the latter reflects a human subject as only understanding an explanation if she connects represented propositions (the explanation) with correct inferences while using default reasoning – usually performed implicitly. This is an ability *S* executes while building a situation model that includes the causal, logical, or probabilistic relations between each step in the explanation. The extra abilities we have to make such inferences reflect our intuition that understanding is a greater cognitive achievement than knowing.

Fourth, these abilities that distinguish (K) from (U) are a form of knowing-how to do something, and are not a form of propositional knowledge, which is a knowing-that. The two forms of knowledge are treated as non-reducible. IMU therefore commits to anti-intellectualism with regard to this distinction.¹¹ This is not quite the same thing as rejecting propositionalism, which is the claim that all understanding-relevant explanatory knowledge is propositional in nature, though they are related theses.¹²

Fifth, (UT) takes an entire scientific theory as its object of understanding, not merely a proposition or an explanation for some fact.¹³ (UT) focuses on the notion of *qualitative* problem-solving, rather than its quantitative correlative – reflecting recent work in the cognitive psychology of science which suggests qualitative understanding, not quantitative problem-solving, is the defining ability indicative of expert scientists rather than novices. (UT) requires for theoretical understanding that a scientist be *reliably* capable of applying specific theoretical principles to solve qualitative problems. This reliability allows for cases where an expert occasionally fails to live up to their abilities. (UT) also requires the solutions they provide be “conditionally true” – correct according to the theory being used – even though they may not reflect the way the world actually operates. Achieving (UT) reflects the intuition that understanding a theory is a much more impressive accomplishment than either understanding a proposition or understanding an explanation, and one that requires a great deal of expert skill as well as knowledge.¹⁴

I think with IMU we can remedy many of EU’s problems. To do this the above definitions have to be synthesized with EU, and this will require a little explanation.

We start by looking at (K) and its relation to EU in terms of EJ, WF, and BB*. (K) tells us what it is to know an explanation. (K)’s “accurate, justified representation” is an implicit placeholder both for justified belief and true belief, so although (K) looks like too liberal a condition for knowledge, it really does still require some account of justification. Here that would be filled by Evidentialism: EJ demands our doxastic attitudes fit the evidence, WF ensures they are well-formed, and BB* provides a constraint on the role of our background knowledge. Are any of these clauses, individually or as a collective, incompatible with (K)? No. (K) is a minimal requirement for knowing an explanation in the sense that it can act as a schema for any number of approaches to defining knowledge. There is for instance nothing obviously internalist or externalist about (K), it simply asserts that to have knowledge of an explanation is to represent the explanatory propositional content accurately. The additional conditions Evidentialism puts on knowledge are not incompatible with (K) because they fill in the details of what this “accurate, justified

representation” really amounts to. For instance, (K) is satisfied under Evidentialism if our representation of p includes having moderate access to mental states that are evidence for p , and p seems to be the best explanation of that evidence.¹⁵

What of (U)? Well, here we *do* see an incompatibility with EU. EU *appears* to cover the sort of inferential abilities one might think concern only (U): causal, logical, and probabilistic. But really EU does not, or should not, license these abilities. Since Feldman only uses examples of categorizing experiences, EU can only speak to categorization inferences, and hence would only comport neatly with (U) if these inferences were the same kind as those we use to draw causal, logical, and probabilistic conclusions. But they are not. *This is the crux of the difference between EU and (U)*. With EU our inferences use rules that enable us to make sense of an experience, be it perceiving a fuzzy object as a cat, or grasping the meaning of an expression. These categorization and interpretation inferences require relatively little cognitive energy.

On the other hand, to follow along with an explanation, as in (U), requires we recognize both the appropriate relations and their relata. The first task is a matter of correctly identifying the explanation’s “generative relations.” These are the relations that attribute an *explanandum* to the factor or factors that produced it. We will fail to understand an explanation unless we pick out the correct relations between parts of the narrative that constitute the *explanans*, and this can be done only if we have already accepted those generative relations and encoded them into long-term memory. Even then, we still need to infer to the correct kind of relation, and select it from among many contenders that may be responsible for the next step in an explanation. For instance, as the psychologist Stellan Ohlsson (2002) has argued, there are many different verbs that cover the production of Y by X . For instance “allowed,” “caused,” “created,” “forced,” “gave rise to,” “generated,” “was a sufficient condition for.” Unless the subject already possesses an appropriate relation, pulls it out of memory and applies it correctly to the explanatory step in the explanation, then they really won’t understand. They will perhaps misunderstand, or understand a different explanation, but making the correct inferential move is essential to identifying each and every generative relation in the explanation.

For instance in Muon there is a step where we are told “Time dilation is given by the relation: $\Delta t = \Delta t_0 / \sqrt{1 - (u^2/c^2)}$.” This generation relation is not causal – it should be read as a sufficient condition only. It would be a mistake for S to treat a change in proper time as being caused by a change in the Earth’s relative time, even though treating the former as sufficient for the latter is appropriate. Possessing and selecting the

appropriate generative relations is therefore an essential component in the difference between knowing and understanding an explanation. In order to accomplish explanatory understanding, not only must we recognize generative relations, we must “articulate an explanation schema” for these relations to instantiate (Ohlsson 2002). An explanation schema is a familiar psychological notion: a type of cognitive structure defined by a set of generative relations. One may find many different explanations instantiate the same abstract structure by appealing to the same set of generative relations. For example, the generative relations “eating generates growth” and “greater size generates slower movement” can be used to articulate the following simple (although incorrect) explanatory schema to explain the dinosaur extinction: “the dinosaurs ate a lot which caused them to grow enormous, which slowed their escape from predators.” The same explanation schema can be used to explain the size of the giant tortoise: “their ancestors ate a lot, which made them very large, and that made them really slow.” These are both terrible explanations, but illustrate the point that a single schema (which can incorporate one or more generative relations) can be used to explain many different phenomena.

IMU adopts the idea that explanatory understanding (U) surpasses the cognitive achievement of knowledge (K) in virtue of the subject activating not only appropriate generative relations from memory, but also articulating those relations in the correct explanatory schema. Without these skills we may come to understand linguistically what is being said, but fail to insert the appropriate relations or relata, and hence fail to explanatorily understand.

Finally, what of (UT)? How can that be synthesized with Evidentialism? Well, the bottom line is that it cannot. As we have seen, Evidentialism is an approach to justification and knowledge, highlighting the transparency of our experiences as reasons for belief. It is therefore in stark contrast with the requirements of (UT) which emphasize the reliable problem-solving abilities of subjects. Clearly (UT) adopts an externalist measure of qualitative understanding, whereas Evidentialism’s core commitment is to the relations between our internal states (in particular our beliefs and evidence). An Evidentialist account of understanding therefore seems to have no hope of accounting for our theoretical understanding.

This should not be surprising, or even of serious concern to the Evidentialist. The form of deliberative reasoning required for (UT) is very different from the default reasoning indicative of our explanatory understanding. We should not expect an epistemology designed to account for one type of reasoning to necessarily cover all others. And since our primary target in this essay is explanatory understanding (U), this is really not a problem for us. I therefore set (UT) to one side in the remainder

of this chapter. The primary point of introducing (UT) is to contrast its deliberative reasoning with the default reasoning found in generating (U). This is important to appreciate because overlooking the different kinds of reasoning, and their accompanying different kinds of epistemic norms, has led many philosophers to provide rather unidimensional accounts of understanding – as if we should expect one size to fit all. In what remains I argue in defense of IMU’s distinction between (K) and (U), then show how an Evidentialist version of IMU might evade the problems we’ve seen EU encounter.

6 EVIDENTIALIST-IMU, INTELLECTUALISM, AND PROPOSITIONALISM

According to IMU, the steps we take in identifying appropriate generative relations and explanatory schema are explanatory inferences because they show how a current step in an explanation is itself explained by a network of previous states. Even if one treats generative relations and explanation schema memories as propositional objects, picking the right ones out and applying them to the *explanans* is not propositional. These kinds of inferences are heavily dependent upon using our dispositions to identify dependency relations and explanatory structures, and are therefore more demanding than representing mere propositional knowledge. They are abilities that express knowledge-how to inferentially connect “islands” of propositions with “bridges” of generative relations that fall within an acknowledged template for explanation. Again, this is what distinguishes mere representation (K) from inferential comprehension (U).

A consequence of note is that because EU treats the understanding of some fact as a matter of mere propositional knowledge, while IMU treats it as requiring knowledge-how, a new version of EU that incorporates IMU, call it Evidentialist-IMU, must include these additional inferential abilities and give up its claim to propositionalism.

Evidentialist-IMU: *S* understands why some fact *f* obtains if and only if *S* creates an accurate, justified representation of a correct explanation of *f* whose propositional content is internally connected by correct inferences.

Here I want to consider some concerns with this strategy. Against my move, there are two ways of arguing for retaining propositionalism in this context. First, one can adopt intellectualism, and argue that although knowledge-how is indeed necessary for understanding an explanation, it reduces to knowledge-that, and hence understanding really is ultimately a propositional issue. The second approach is to embrace

anti-intellectualism, and accept the two forms of knowledge as distinct, yet reject the need for knowing-how in coming to understand an explanation by claiming explanatory understanding is entirely knowledge-that (i.e. adopt propositionalism directly).

We are dealing here with the distinction between (K) and (U), so to maintain IMU it must be shown that the two are not collapsible. There are some very detailed arguments that arise in the literature here, and although I don't have the space to address them all, a slightly deeper look at these issues is warranted given their importance to adjudicating between EU and IMU. To defend IMU on the first accusation (that we can reduce know-how to know-that) I think there are very good reasons to reject intellectualism. Gilbert Ryle (1949) initiated the modern discussion with his "Fool" argument: we can imagine a clever chess player imparting all his knowledge and wisdom to a stupid opponent; his opponent might memorize and be able to recite all he is told, yet still play without intelligence.

As John Bengson and Marc Moffett (2011a, 14) point out, "intelligence" for Ryle is definable in terms of knowing-how, and the fool argument is supposed to show knowing-how does not supervene on propositional attitudes. The idea driving anti-intellectualism is that what distinguishes knowing-how from knowing-that lies in our non-reducible abilities or dispositions. This is the difference which separates EU from IMU.

But the fool argument has not convinced everyone. There are several popular responses from intellectualists that try to describe the kind of attitudes involved in exercising an intelligent behavior (knowing-how) which does not degenerate into an ability or disposition. Most focus on know-how as practical knowledge. For instance, Jason Stanley and Timothy Williamson (2001) argue that practical knowledge involves contemplating a proposition under a "practical mode of presentation." In Ryle's chess example this would mean both players have the same propositional knowledge regarding chess, but the fool does not possess it under the appropriate practical mode of presentation. The same would go for a subject who failed to understand an explanation. This would mean treating (U) as reducible to (K). However, Stanley and Williamson's notion of a "mode of presentation" is a highly controversial concept, which has, as far as I can tell, no clear way of avoiding collapse into an ability or disposition.¹⁶

A second strategy is to adopt Bengson and Moffett's (2007) view that practical knowledge involves understanding a way of acting, where "understanding" is defined as having a reasonable mastery of the relevant concepts. Here, the fool fails to have reasonable mastery of the chess concepts involved in her propositional knowledge. The same would be true for the fool who fails to understand an explanation.

However, Bengson and Moffett's appeal to understanding concepts faces the following dilemma:

- i If "understanding concepts" amounts to comprehending words and expressions, then this "linguistic understanding" does not go far enough to accommodate the inferential abilities we use in comprehending an explanation. This is because categorization skills are assumed in EU as the limit of what we use to acquire explanatory knowledge – recall Feldman's bird-watcher example and the threats of circularity or infinite regress. But as I just argued, (U) requires more than mere categorization skills.
- ii If "understanding concepts" includes our ability to make inferences between propositions in an explanation, (what I have above called "explanatory understanding"), then on a propositional approach it begs the question. What is it about understanding a concept that propositionally licenses inferential moves in an explanation? For Bengson and Moffett it must not be an ability or disposition, but then what is it?

To be fair, the above sort of suggestions for how to account for intelligent action using only attitudes, gets further momentum from examples that purport to show knowledge-how is itself not dependent on abilities or dispositions. For instance, the skier who becomes paralyzed still knows-how to ski, although she no longer has the ability to do so. This example supposedly shows one can have know-how without the ability to express it. And if know-how can be detached from abilities or dispositions, then knowing-how must not supervene on such abilities or dispositions, and anti-intellectualism is wrong.

But a good response to this sort of counterexample is for the anti-intellectualist to provide one of her own. For instance, think again of Bob and Bob*. Clearly the latter lacks knowledge-that (since he is lucky). Still, he knows-how to explain a muon's path to earth in exactly the same way Bob does. There seems to be no relevant *explanatory* difference between them. But being able to explain is a form of knowing how to do something. So, we can have knowledge-how but lack the relevant knowledge-that. Similar examples are easy to produce,¹⁷ and between them and the ski instructor example we have undermining evidence against both intellectualism and anti-intellectualism.

I conclude that although the Fool argument is not decisive, alternative positive intellectualist accounts are similarly problematic. I take it this shows anti-intellectualists need to refine their view, but not that anti-intellectualism is the less plausible account.¹⁸

Moving on to defend IMU on the second accusation, (that know-how is unnecessary for understanding an explanation), there are good reasons to think propositionalism incorrect. Remember propositionalism is the claim that all understanding-relevant explanatory knowledge is propositional in nature. To show propositionalism incorrect, consider how two versions of intellectualism (advanced by Stanley and Williamson, and by Bengson and Moffett) treat know-how:¹⁹

- i “John knows how to find coffee in New York.” (test sentence)
- ii “For some way *w*, John knows that he can find coffee in New York in way *w*.” (Stanley and Williamson’s interpretation)
- iii “John knows the way to find coffee in New York.” (Bengson and Moffett’s interpretation)
- iv “John is able to find coffee in New York.” (anti-intellectualist interpretation)

If we take sentence (i) as our sample knowledge-how ascription, then (ii) and (iii) are offered as alternative intellectualist readings. These alternatives each attempt to reduce (i). Sentence (ii) attempts to reduce (i) to a form of knowledge-that, while sentence (iii) attempts to reduce it to objectual knowledge. In (iv) above, there is an obvious gap between knowing-how to find coffee and actually being able to do it. It is similar to the skier case. This difference between (i) and (iv) perhaps gives (ii) and (iii) some credibility. It is not clear that (iv) is the better reading of (i) than either of the other alternatives.

Now contrast the above with a new test sentence which reflects explanatory understanding:

- 1 “John knows how to derive the *explanandum* from the *explanans*.”
- 2 “For some way *w*, John knows that he can derive the *explanandum* from the *explanans* in way *w*.”
- 3 “John knows the way to derive the *explanandum* from the *explanans*.”
- 4 “John is able to derive the *explanandum* from the *explanans*.”

My suggestion is that unlike the previous example, here, in the case of explanatory understanding, (4) is more intuitively synonymous with (1) than either (2) or (3). A point in favor of this is that both (1) and (4) leave open alternative ways of deriving the *explanandum*, whereas (2) and (3) are unnecessarily specific. (3) is especially restrictive, since it has connotations of there being only one way to derive the explanation. But (2) also has a sense which seems too restrictive. It says John knows some way to derive the *explanandum*, and this at least *sounds* like an

existential statement on ways to do things. I don't deny John must have such knowledge, but it sounds less synonymous with (1) than claiming John is simply able to do it.

Perhaps more importantly, cases of understanding an explanation are intellectual, and do not require physical abilities to perform acts, such as are required when finding coffee shops. This makes explanatory understanding an internal, entirely cognitive achievement, and hence not subject to the know-how/ability separation we find in (i) and (iv) above in coffee shop locating tasks. This is an important, and crucial, difference which helps us appreciate why explanatory understanding requires know-how, and illustrates the essential difference IMU highlights between (K) and (U).

7 EVIDENTIALIST-IMU RESCUES EU

The last section took us far from the initial goal of articulating Evidentialist-IMU. It was necessary because IMU rejects propositionism, while EU accepts it. The remainder of the task of articulating Evidentialist-IMU can be achieved by showing how it resolves problems that arose for its predecessor.

- 1 *Knowledge is not necessary for understanding*: EU says Bob* fails to understand the muon explanation because EU requires he not be lucky in his beliefs. Evidentialist-IMU however adopts (U) as its criterion, and this definition requires no such anti-luck condition. Because it does not require Bob* have knowledge, Evidentialist-IMU can happily endorse our intuitions that Bob* really does understand *emuon*, even if he doesn't know the explanation.
- 2 *Knowledge is not sufficient for understanding*: If the kind of knowledge at issue is merely propositional knowledge then Evidentialist-IMU says this is not sufficient for understanding. As the previous section on propositionism was designed to show, Evidentialist-IMU adopts the view that knowing-how is also necessary for understanding an explanation, and this explains why Bill who has only propositional knowledge of muons does not really understand them, while Bob who also has know-how does understand them.
- 3 *Over-intellectualizing*: Evidentialist-IMU does not adopt IBE as its method of explanation selection. It treats explanation selection as the cognitive process of schema articulation. Presumably there are many schemas available in memory for us as we are processing an explanation, so how do we choose? As a naturalistic account informed by work in cognitive psychology, IMU looks to studies by

psychologists. The evidence is still coming in, but one promising account of how we resolve this conflict is given by the ACT-R theory (Anderson and Labiere 1998). On this view, the activation and selection of knowledge structures is an *implicit* process controlled by a probability function between two variables: past usefulness (strength) and contextual relevance (activation). During probabilistic conflict resolution both current knowledge activation as well as past performance are highly relevant. This is most often a non-conscious decision. We can therefore treat explanation selection as another form of default reasoning. Consequently, sticking to (U), all Evidentialist-IMU requires is the ability to make appropriate inferences, and this says nothing of consciously comparing explanations, so objection (3) is dissolved.

One might question how this default decision can be justified on Evidentialist grounds. After all, there is no “seeming” of a best explanation; just an implicit choice based on a probability function. However, with Evidentialism treated as mentalism, real-time direct access to our probability calculations is unnecessary. These are non-conscious mental states which evaluate our knowledge structures for the best explanatory schema. The fact that they are not conscious does not undermine their use as evidence – they are clearly playing an evidential role for us.

- 4 *Circularity*: Since Evidentialist-IMU does not require *S* execute an IBE, or anything of the sort, there is no risk of circularly.

8 CONCLUSION

On the face of it Evidentialism is not a very promising approach to understanding – it demands we have propositional knowledge whose justification is based primarily on the evidential relation, yet evidence doesn't seem to be a central notion when it comes to understanding. We have seen that a straightforward propositional approach to understanding along these lines also suffers from some devastating problems. I have tried to show how the route to solving these problems is twofold: (i) reject propositionalism and intellectualism with regard to how understanding is related to knowledge, and (ii) reject the need for an explicit explanatory decision-making process. I have argued that by adopting the inferential model of understanding we accomplish both of these tasks and restore the central notion of inferential ability to our concept of explanatory understanding. This may not be the only route to achieving this goal but it has the advantage of being a naturalistically informed account which also gives respect and credit to our more armchair methods.

NOTES

- 1 The right-hand side of this biconditional, “S knows an explanation *e* of *f*” might be interpreted in different ways. For instance, it may be taken as “S knows what explanation *e* says.” Alternatively, it could be taken in a more demanding sense, such as “S knows how the *explanandum* follows from the *explanans*.” It will be part of what follows to tease these readings apart.
- 2 This is not the problem we will face below which claims that knowledge of an explanation, even with quite deep linguistic understanding of the sentences involved, is not sufficient for understanding an explanation.
- 3 One move here is Kevin McCain’s (2014) suggestion that Evidentialism adopt James Woodward’s (2003) interventionist account to provide a condition for the appropriate basing relation. I think this has promise, but I have to leave it to one side here.
- 4 This interpretation coheres with McCain’s (2014) approach to seemings.
- 5 In what follows I will use the expression “understand an explanation” to refer to this more demanding sense of understanding, not mere linguistic understanding.
- 6 This is in fact the view held by Feldman, as restrictive as it seems. See Conee and Feldman 2004, 232.
- 7 Kareem Khalifa adopts a similar approach with his “explanatory reliabilism” (Khalifa 2012), although as the name suggests, his is not a form of Evidentialism.
- 8 Newman (2012, 2013, 2014, forthcoming).
- 9 One can thus imagine inserting other epistemologies into the IMU framework to solve similar problems.
- 10 In previous work I refer to this as “comprehension.”
- 11 Intellectualism is the thesis that knowledge-how is at least partly grounded in, if not reducible to, knowledge-that. Anti-intellectualism is the denial of intellectualism, and thus asserts knowledge-how is not grounded in knowledge-that at all.
- 12 Anti-intellectualism is a thesis about the relationship between knowing-that and knowing-how, whereas propositionalism is a thesis specifically about the kind of knowledge required for understanding. If the intellectualist is correct and knowledge-how is reducible to knowledge-that, then anti-propositionalism, of course, falls with it.
- 13 It might be possible to extend (UT) to non-scientific theories, but here my analysis is based only on the work of expert scientists.
- 14 For full details on how IMU treats theoretical understanding see Newman (forthcoming).
- 15 Although Feldman argues for more restrictive access conditions, I follow McCain’s more plausible interpretation of access as being dispositional.
- 16 For an argument along these lines see Koethe (2002).
- 17 See Yuri Cath’s examples of the lucky light bulb and hallucinating jugglers in his (2011).
- 18 In fact just such refinements have already been attempted by some. Hawley (2003) has for instance attempted to refine the view by appeal to the counterfactual: “if *x* knows how to ϕ under certain circumstances, then if *x* tried to ϕ under those circumstances, then *x* would successfully ϕ .”
- 19 See Bengson and Moffett (2011b, 180–1).

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