

Irreducibility of Understanding-Why to Knowledge of Cause

Unravelling the Confusion

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Abstract

Whether understanding-why is reducible to propositional knowledge of cause is among the most debated issues in the philosophy of understanding. Many anti-reductionists consider that understanding comprises a set of cognitive abilities and that it is different from having propositional knowledge. In contrast, one strategy that reductionists adopt is showing that such abilities constituting understanding are also required for propositional knowledge. This paper aims to show that this type of strategy fails because it confuses abilities pre-required for propositional knowledge with ones that are constituents of understanding. Undeniably, an agent is sometimes required to answer some type of ‘What-if’ questions in order to have propositional knowledge. However, this only shows that the agent is required to understand concepts that appear in a proposition in order to know the proposition. It is thus important to examine the “process”—how the agent has a belief when judging whether the agent has propositional knowledge—while it is important to examine the “achievement” when judging whether the agent understands the phenomenon at issue.

Keywords

cognitive ability; epistemic value; propositional knowledge; understanding-why; virtue epistemology

1 Introduction

Whether understanding-why can be reduced to propositional knowledge is among the most debated issues in the philosophy of understanding. Some anti-reductionists (who insist that understanding-why is irreducible to propositional knowledge), such as De Regt [2009, 2020] and Hills [2016], insist that understanding comprises abilities that do not constitute propositional knowledge.

However, some reductionists, such as Sullivan [2018] and Hu [2019], criticise this type of anti-reductionism by insisting that abilities constituting understanding are also required for propositional knowledge.¹ That is, their strategy is to show that understanding is reducible to having propositional knowledge even if the anti-reductionists' claim is accepted. This strategy contrasts with another adopted by reductionists such as Sliwa [2015] to show that understanding is reducible to propositional knowledge by considering additional knowledge. According to the former strategy, understanding certainly requires cognitive abilities; however, knowledge also requires the same kind of cognitive abilities (thus, understanding is reducible). Conversely, according to the latter strategy, understanding is reducible because it does not require any special kind of cognitive abilities.

This paper aims to show that the former strategy fails as it confuses pre-requisite abilities for propositional knowledge with abilities that are constituents of understanding. In other words, this paper shows that (although I do not deny that the agent must use cognitive abilities to understand) she must acquire some sort of cognitive ability to understand, whereas she must use some sort of cognitive ability to possess propositional knowledge (as virtue epistemology insists).

Namely, to judge if an agent has knowledge, we focus on how her (true) belief is formed. In contrast, to judge if an agent has understanding, we do not need to consider how her understanding is formed but rather what kind of ability she acquires. For example, some authors such as Hills [2016: 672] consider that understanding is compatible with “epistemic luck” but knowledge is not. Regardless of whether their arguments are correct, the fact that such arguments have a certain persuasive force indicates that while the acquisition process is emphasised in the case of knowledge (thus, epistemic luck must be excluded), this is not so in the case of understanding (thus, epistemic luck is acceptable).

¹ Grimm [2010, 2014] also insists that knowledge requires the epistemic ability called ‘grasping’ that many anti-reductionists consider to be necessary for understanding why. However, Grimm considers that knowledge of the cause is not propositional, although understanding why is reducible to knowledge of the cause.

This paper specifically examines two arguments adopting this strategy: those by Sullivan [2018] and Hu [2019]. Sullivan insists that in order to know propositions, the agent has to use abilities that Hills [2016] suggests are constituents for understanding-why. It is relatively easy to see the kind of confusion that Sullivan faces. Namely, the agent acquires cognitive abilities by understanding-why (more precisely, understanding-why is identified with acquiring cognitive abilities). In contrast, although, undoubtedly, the agent has to *use* some kind of cognitive abilities to have propositional knowledge (thus, they have to have cognitive abilities *beforehand*), the agent acquires no new cognitive abilities by merely having propositional knowledge.

In contrast, Hu's confusion is more difficult to see. Anti-reductionists insist that an agent must answer some what-if questions to state that they have understanding-why. However, Hu argues that the agent who *knows* propositions concerning causes also has to be able to answer what-if questions that anti-reductionists suggest as the criteria for understanding-why. However, in this paper, I insist that the reason why the agent who merely knows the proposition can answer the what-if questions is not that the agent acquires new abilities but that they understood the concept of causation (and possess the ability to exclude some events from the candidates of causes) beforehand.

This paper shows that Hu's argument fails by providing some examples of what-if questions that an agent who merely knows the proposition that *q* causes *p* but does not understand why *p* cannot correctly answer. However, some may consider the word 'fail' to be too strong. Hu acknowledges the limitation of his argument; namely, he [2019: 309] states "I did not claim that knowledge that *X* was caused by *Y* is sufficient for a sophisticated understanding of why *X* occurred".

He is surely correct in that propositional knowledge requires some rudimentary "grasp". Nonetheless, it would be useful to show why his argument seems to be successful regarding a rudimentary understanding. My response is that this is because an agent must first understand the concept of causation and possess the ability to exclude some events from the candidates of causes in order to have knowledge of the cause. In contrast, the reason why Hu's argument cannot extend to a deeper understanding is that a deeper understanding consists of more sophisticated abilities than those required for having propositional knowledge.

The structure of the remainder of this paper is as follows. In Section 2, I summarise Sullivan's argument and show that what she proves is merely that an agent has to *use* some kind of cognitive abilities to have propositional knowledge. In Section 3, I summarise Hu's argument and show that what Hu proves is that having the propositional knowledge that *q* causes *p* requires an understanding of the concept of causation. I also provide an example in

which the agent does not possess even propositional knowledge although she can answer a what-if question. This shows that the ability to answer this type of what-if question implies that the agent understands the concept of causation and has the ability to rule out some events as causes before having knowledge of cause; thus, these abilities are not acquired as the result of knowledge of the cause (these abilities and having knowledge cannot be identified). In addition, I provide some what-if questions that an agent who merely knows the proposition ‘q causes p’ but does not understand why p cannot answer. Section 4 comprises the summary and discussion wherein I argue the importance of Sullivan’s and Hu’s arguments, although the arguments themselves fail (or are, at least, limited).

2 Agent must use cognitive abilities to have propositional knowledge

Hills [2016: 663] argues that, for an agent to be able to state that they understand why p, they must have the following set of abilities, called “cognitive control”:

If you understand why p (and q is why p), then you believe that p and that q is why p and in the right sort of circumstances you can successfully:²

- (1) follow some explanation of why p given by someone else.
- (2) explain why p in your own words.
- (3) draw the conclusion that p (or that probably p) from the information that q.
- (4) draw the conclusion that p* (or that probably p*) from the information that q* (where p* and q* are similar to but not identical to p and q).
- (5) given the information that p, give the right explanation, q.
- (6) given the information that p*, give the right explanation, q*.

However, Sullivan insists that propositional knowledge also requires cognitive control. For example, suppose that a detective knows, because of their investigation, that a client’s wife is having an affair. If they are a good detective, they know this proposition by distinguishing trustworthy sources from untrustworthy ones. This is undoubtedly a kind of cognitive

² In this quotation, I have changed p' (q') to p* (q*) to avoid confusion.

ability. Additionally, according to Sullivan, this ability is not a kind of know-how as it is a constituent of propositional knowledge (she calls this kind of ability ABILITY_{JUDGEMENTAL}).

Her claim is as follows. The kind of abilities constitutive of understanding are ABILITY_{JUDGEMENTAL} and ABILITY_{FUNCTIONAL} (that is, the ability to form a true belief that is the result of a non-intentional and purely functional process), the same as those constitutive of knowing-that; they are not abilities characteristic of abilities typically associated with practical know-how.

For example, consider ability (1) that Hills requires. Simply following an explanation involves an ability to comprehend a sentence uttered by a speaker or a series of sentences written in a book. This ability is also required to have propositional knowledge. Similarly, ability (2) is also required for propositional knowledge. These abilities are ABILITY_{FUNCTIONAL}.

Let us move on to abilities (3) and (4). Sullivan [2018: 234] states:

[O]ne could colloquially say about someone who has this ability that she ‘knows how to draw the correct conclusion from a set of evidence or information’. If any of the abilities for understanding-why resemble practical know-how, this is the one.

Subsequently, she insists that this is ABILITY_{JUDGEMENTAL}. Sullivan [2018: 234] further states:

Consider our good detective. He is able to reliably distinguish trustworthy sources of information from non-trustworthy sources. Since he has this ability, in any case where a trustworthy source gives him a piece of information he knows that the information is accurate. It is because he forms a true belief in virtue of having this ability that he has propositional knowledge. [...] [W]e could re-describe this case to say that the good detective ‘knows how to draw the conclusion that so-and-so is a trustworthy source given the information at hand’.

However, in my diagnosis, this is the point at which Sullivan is confused. For example, Alice knows that *q* is the cause of *p* by reading a reliable textbook, *T*. In this case, Alice certainly has the ability to judge if *T* is reliable. Then, she can certainly draw the conclusion that *q* is the cause of *p* from the information written in *T*. Nevertheless, this fact does not guarantee that Alice can draw the conclusion *p* from the information *q* (or, at least, *p*^{*} from the information *q*^{*}), and if she cannot, it cannot then be stated that Alice understands why *p*.

For example, suppose that Alice considers a textbook of chemistry T_C to be reliable because her chemistry teacher tells her T_C is recommendable and she reads many good reviews of the textbook online (call this information I_C). Suppose she also reads that T_C states that the shape of an NH_3 molecule is a trigonal pyramid (q_S), which causes the polarity of NH_3 (p_S). She believes this proposition, S (q_S causes p_S), because of the reliability of T_C . Then, it is reasonable to state that she knows S . In addition, it is certain that she can judge whether T_C is reliable using her cognitive ability (thus, her belief deserves to be called knowledge.).

However, her ability to judge if T_C is reliable does not mean that she can also conclude the polarity of NH_3 from the fact that the shape of the NH_3 molecule is a trigonal pyramid. The ability that she has is to infer S (q_S causes p_S) from I_P (which shows the textbook T_P to be reliable), not one to infer p_S from q_S (she knows that q_S causes p_S , not because she can infer p_S from q_S).

Therefore, Alice might be able to infer another proposition (q_W), ‘the shape of the water molecule (H_2O) is bent’, written in the chemistry book T_C , from the information I_C . However, it is not guaranteed that Alice can infer the polarity of the water from the information on the shape of the water molecule, since she might not understand why p_S (NH_3 has polarity). Nevertheless, this is ability (4), namely, to draw conclusion p^* (in this case, polarity of the water) from information q^* (the shape of the water molecule). Therefore, Alice does not acquire ability (4) by knowing S , and this is because Alice does not understand why p_S . In addition, in this case, it is legitimate to state that Alice knows S but does not understand why p_S . In contrast, if Alice correctly infers that water molecules have polarity because of q_W , then it is legitimate to state that Alice understands why p_S .

This indicates that, on the one hand, an agent must have cognitive abilities *before* they know a proposition; they must *use* cognitive control to know a proposition. On the other hand, understanding-why is identified with acquiring cognitive abilities (and these abilities are different even though they might be of the same *kind*—they could be what Sullivan calls $ABILITY_{JUDGEMENTAL}$); they understand why p by acquiring cognitive ability.

However, Sullivan [2018: 235] states the following argument regarding ability (4):

Given that what I have said about ability (3) is correct, I see ability (4) as expressing a safety criterion on understanding. In any case of propositional knowledge, in order to have knowledge the knower must be able to get the truth not just on this particular occasion, but get things right even if conditions were slightly different.

This seems plausible. Nevertheless, this does not mean that the agent has ability (4) *concerning the phenomenon in issue*. Sullivan [2018: 225] insists:

If it so happened that the batteries in the unfortunate homeowner's basement were AA batteries, the fire would not have started. It seems reasonable that in order to know the cause of the fire one would still need to have a true belief about the state of the house in the case where the batteries were different. It is reasonable to suggest that if one could draw the conclusion that the fire started because of the 9 V batteries' interaction with a cardboard box, then one could also draw the conclusion that if the batteries inside the box were AA, then the fire would not have happened.

However, I do not agree with this argument because Sullivan assumes that the agent already has the ability that constitutes understanding-why (she can conclude that the fire started because of 9V batteries from the information that 9V batteries interact with a cardboard box). As discussed, what the agent must possess to know that 9V batteries are the cause of the fire is the ability to judge whose testimony they must believe.

This ability is different from an ability to conclude that the fire started because of 9V batteries from the information that 9V batteries interact with a cardboard box. Therefore, I disagree with Sullivan's argument that the agent who knows that the fire started because of 9V batteries could also conclude that if the batteries inside the box were AA, then the fire would not have happened. This situation is the same as the one I discussed above (polarity of NH_3 and water molecules).

I believe that it is reasonable that the agent does not need to have the ability to infer a proposition (A), that AA batteries would not have started the fire, in order to state that they know that 9V batteries are the cause of the fire. If they can infer this proposition, A, then it is legitimate to state that they *understand* why the fire started. By contrast, it is also legitimate to state that they know that 9V batteries caused the fire, even if they could not infer A. In fact, how could we infer that AA batteries would not have caused the fire from the fact that 9V batteries were the actual cause of the fire?

However, some readers might wonder why I stated 'This seems plausible' concerning the two previous quotations from Sullivan [2018: 235] starting with 'Given that...' if I disagree with Sullivan's argument as discussed above. In this case of the fire, the marshal informs the homeowner that the cause of the fire is old 9V batteries, and the homeowner informs their young daughter of the same (namely, the informer of the daughter is her parent). However, if the marshal had directly told the daughter that the cause of the fire was old 9V batteries, the daughter would then have believed the marshal's testimony because of her epistemic ability

(she can conclude that the information from the marshal is trustworthy). Nevertheless, again, this fact does not guarantee that the daughter can also draw the conclusion that AA batteries would not have caused the fire and that putting tape across the top of the batteries might have prevented the fire. Therefore, having propositional knowledge does not require the cognitive ability (4) that understanding-why requires.

As discussed above, Sullivan's strategy is to show that an agent has to use her cognitive abilities that, according to Hills, are required for understanding when the agent acquires knowledge. In contrast, this paper shows that agents surely need to use cognitive abilities to know the cause of a phenomenon *p*, but these abilities are not necessarily identified with understanding-why *p*.

However, Hu [2019] provides examples showing that if the agent cannot answer some what-if question, then it cannot even be stated that she does not know the cause. The point of my argument against Hu is the same as that against Sullivan; it is important to distinguish the abilities required for having knowledge from those constituting understanding. In addition, I also argue that, in order to know a proposition, we have to understand the concepts appearing in the proposition at issue.

3 Agent must understand the concepts appearing in a proposition to know it

3.1 Hu's argument for reductionism

Let us move on to Hu's argument. Hu [2019] rebuts two arguments that anti-reductionists advance. This paper focuses on one of them—understanding-why is constituted by a set of abilities—for two reasons. One reason is that the aim of this paper is to show the confusion of reductionists who adopt a strategy that understanding-why is reducible to propositional knowledge because the abilities constituting understanding-why and required for having propositional knowledge are identified.

The other reason is that, generally, to rebut an argument that *X* can be reduced to *Y*, it is sufficient to show one counterexample that *X* cannot be reduced to *Y* (and I show such some counterexamples in this section: examples that understanding-why cannot be reduced to propositional knowledge).

In the previous section, I insisted that Sullivan confused the pre-required ability for having propositional knowledge (the agent has to *use* the ability to have propositional knowledge) and the ability associated with understanding-why (the agent *comes to have*

ability if they understand why p) because, if the agent has the ability to distinguish a trustworthy source from others to have knowledge that q causes p, this does not guarantee that the agent could infer that if q^* had happened, then p^* would have happened.

However, Hu's example shows that an agent with propositional knowledge that q causes p should be able to infer that if q had not happened, then p would not have happened (identified with Hill's ability (4)). Still, I show that Hu also confuses the pre-required ability for having propositional knowledge and ability associated with understanding-why in a different way from Sullivan's.

Consider a child that pushes her toy car [Hu, 2019: 295–6]:

Suppose she believes that the car is moving because she pushed it, but when asked, 'What if you had not pushed the car (*ceteris paribus*)?' She gets lost and does not know what to say. Then intuitively, she does not know that the car is moving because she pushed it. [...] In order to know this causal relationship, my child must be able to answer a few 'What- if?' questions such as 'What if you had not pushed the car?' and 'What if you had not hummed to yourself?' This case seems to generalize.

This example seems to have persuasive power to show that having propositional knowledge requires cognitive control. Indeed, cognitive control is necessary for propositional knowledge.

3.2 Requirement of understanding the concept of causation for propositional knowledge

However, the point here is that an agent must have such abilities (namely, for example, the ability to exclude some events from the candidates for causes) *before* having propositional knowledge of the cause. If the agent understands the concept of causation, they should then understand that 'q causes p' means 'if q had not happened, then p would not have happened'. Therefore, the agent's ability to answer the question 'What if q had not happened?' is insufficient to distinguish understanding-why from mere propositional knowledge. They must answer other types of what-if questions. Hu [2019: 297] also recognises this criticism. In response, he states:

If one knows that Y is among the causes of X, then one knows not only what 'Y is among the causes of X' means, but also knows the metaphysical proposition that *ceteris paribus*, if Y had not happened, X would not have happened.

However, I insist that the reason the agent knows such a metaphysical proposition is that she understands the concept of causation as discussed above.

In addition, he suggests the following:³

- (1) One knows that P (no matter whether it is via testimony or not) only if one can rule out the relevant alternatives to P.
- (2) Thus, there is a set of events, E, such that if one cannot rule out the possibility that X was caused by any member of E, then one does not know that X was caused by Y.
- (3) But if one can rule out the possibility that X was caused by a certain member of E, then one can answer that X would still have happened when asked ‘What if that member of E were different in a certain way (*ceteris paribus*)?’
- (4) Therefore, if one knows that X was caused by Y, one can answer this sort of ‘What-if?’ question. [Hu 2019: 297]

Thus, to know that the toy car is moving because she pushed it, the child must be able to rule out all these alternatives, such as that the toy car is moving because she named her dog ‘Mia’.

I agree with (1)–(4). Nonetheless, again, I insist that the reason why the child has these abilities is not because these abilities and the possession of knowledge have been identified; the child instead has the ability to rule out some events as causes *beforehand*. There are two possible cases. One is where the alternatives to P are clearly ruled out as the reason the car is moving (she named her dog ‘Mia’). The other is where the agent wondered what was the cause of the car’s moving, the alternative or P. In the former case, the agent ruled out the alternatives *before* they knew P.

For example, I know that my cat sitting on my keyboard did not cause the car collision that occurred on the road in front of the nearest station (p_A), even though I do not know the cause of p_A . Namely, I can answer the question ‘What if your cat had not sat on your keyboard?’, even though I do not know the cause of p_A ; the answer is ‘the car collision would have happened’. Hu’s example that the child can rule out the alternative that the toy car is moving because she named her dog ‘Mia’ is this type of situation; the child could rule out this alternative before she knows that the cause of the toy car’s moving is from pushing it. Namely, even if she can answer the question ‘What if you did not name your

³ In this quotation, I have changed the lower-case ‘p’ (Hu refers to a proposition) to an upper-case ‘P’ to avoid confusion because the lower-case ‘p’ appears in my text to refer to a phenomenon.

dog ‘Mia’ correctly, this does not guarantee that she knows the cause of the toy moving; she can perhaps rule out naming her dog ‘Mia’ as the reason the toy car is moving, even if she does not know the cause of this phenomenon.

In the latter case, if this is just a rudimentary case, this also means that the child understands the concept of causation beforehand (however, unlike in the former case, she must know the cause). For example, I am wondering which is correct in the following scenario: the cause of a phenomenon (p_T) in which a strange string of text I do not remember typing appears on my PC screen is the fact that my cat walked on my keyboard or that my keyboard is broken. If a PC expert tells me that my keyboard is broken, I can then answer the question, ‘What if your cat had not walked on your keyboard?’; the answer is ‘the strange string of text would have appeared on my PC screen’. However, I am not confident that I *understand* why p_T occurred, although I *know* the cause of p_T , because I do not understand how the broken keyboard resulted in phenomenon p_T . The reason I can answer the question is that I understand the concept of causation (not because I understand why p_T). This is because I have an ability *in general* that, when there are two candidates, q_1 and q_2 , of cause of p , and a reliable informer tells me that q_1 is the cause of p , I can rule out q_2 . Again, although the agent must use this ability to know the cause of the phenomenon, the ability does not constitute identifying the knowledge of the cause. It instead constitutes understanding the concept of cause.

In order to know a proposition, an agent must understand some of the concepts, not necessarily all, that appeared in the proposition. If the child understands the concept of causation and what ‘pushing the car’ means, she should then also know that ‘she named her dog Mia’ is not the cause of the car’s moving when she has learned that her pushing the car causes the car’s moving. Hu [2019: 297–8] provides the following example:

For instance, to know that the animal you are looking at is a zebra, you must be able to rule out that it is a lion, that it is a dog, etc. [...]. If the animal were a lion instead of a zebra, but you would still believe it is a zebra, then you are unable to rule out that it is a lion when it is in fact a zebra, and accordingly, you do not know that it is zebra.

However, the reason the agent can rule out other animals is not that she knows that the animal is a zebra but that she understands that a zebra and, for example, a lion are different. If she did not understand that they are different beforehand, she could not know that the animal she was looking at is a zebra, and could not rule out that it is a lion. Therefore, the cases Hu uses as examples can be explained by this supposition.

It is certain that in our ordinary usage of the words ‘understanding’ and ‘knowledge’ they are sometimes interchangeable. Thus, I do not insist that Hu is totally wrong; rather, he is correct insofar as knowledge of causes involves a rudimentary form of grasp. Nevertheless, even in such cases, strictly speaking, the reasons why it is reasonable to state that the agent knows and to state that the agent understands are different; understanding-why is identified with cognitive abilities while cognitive abilities are required for having propositional knowledge of the cause. Therefore, Hu’s argument breaks down when considering what-if questions whose answers cannot be inferred if the agent merely understands the concept of causation.

In sum, it is true that knowing a cause requires the ability to answer some what-if questions. However, I would like to emphasise that the reason why knowing the cause requires the ability to answer some types of what-if questions is that knowing the cause requires the agent to understand the concept of cause.

As discussed in the previous section, even if an agent knows that 9V batteries caused the fire, it is not guaranteed that the agent can answer the question of what would happen if AA batteries were in the box. In contrast, the agent should be able to answer the question ‘What if no batteries were in the box?’ if the agent knows the cause of fire.

3.3 Deeper what-if questions

Consider again the example of the phenomenon in which the NH_3 molecule has polarity (p_s). Even if the textbook, T_C , explains *how* the shape of NH_3 (trigonal pyramid) causes its polarity, and Alice knows proposition (S), indicating that the shape of the NH_3 molecule causes its polarity, there could be a case in which Alice cannot answer question (W_s): ‘What if the shape of the NH_3 molecule were an equilateral triangle (one N atom located at the centre of the triangle and the three H atoms located at the vertices of the triangle)?’ In this case, it would be reasonable to state that Alice knows proposition S though she does not understand why p_s . Additionally, there could be a case in which Bob can answer the question W_s even though he read the same textbook, T_C , and their background knowledge is the same. The ability to answer W_s is clearly ability (4) suggested by Hills.

Consider another example. In Geology class, Bob has learned *how* the counterclockwise rotation of the earth (viewed from the north pole star) causes a rightward force in the northern hemisphere, and this force (the Coriolis force) causes the vortex of a typhoon to be counterclockwise in the northern hemisphere.

If Bob comes to know proposition (R), that the cause of the vortex of a typhoon being

counterclockwise in the northern hemisphere is the counterclockwise rotation of the earth viewed from the north pole star, does Bob then also understand why the vortex of a typhoon is counterclockwise in the northern hemisphere (this phenomenon is called ' p_R ')? I insist that knowing R is insufficient to state that Bob understands why p_R .

If Bob cannot answer the question, 'What if the earth had not rotated?', it is then legitimate to state that he does not *know* R (as Hu insists). Similarly, it is perhaps reasonable to state that he does not know R if he cannot answer the questions, 'What if the earth had rotated in the opposite direction?', 'What if we observe the vortex of a typhoon (cyclone) in the southern hemisphere?', and so on. These seem to confirm Hu's argument. However, these can be inferred if Bob understands the concept of causation (and, of course, of 'typhoon', 'the rotation of the earth', etc.), and Bob must understand these concepts to know the proposition, R .

Nonetheless, even if Bob knows R , he might not be able to correctly answer the question (W_R), 'What if we observe the vortex of water flowing into the bathtub drain in the northern hemisphere?' If Bob cannot answer this question, it is reasonable to state that he does not understand why p_R . If Bob correctly understands why p_R , he should then know that the effect of the Coriolis force is pronounced for global phenomena (G) *even if the teacher did not explicitly tell him proposition G* . That is, he should have the ability to infer G from the information that the teacher gave him to understand p_R .

Note that these examples are different from an example Hu [2019: 299–301, Objection 2] takes as an apparent counterexample to his theory (the cause of Trump's election in 2019). While that example (Trump's election) has complex causal interactions, our examples have a simple causal process. W_S and W_R are *ceteris paribus* questions.

Some may complain that this standard is too demanding to judge if the agent has understanding-why. I agree that this is a high standard. However, as most reductionists and anti-reductionists accept, understanding comes in degrees. Surely, a low-level understanding-why can often be exchanged with propositional knowledge of the cause, and I do not oppose Hu on this point. However, this fact does not imply that understanding-why can be reduced into propositional knowledge, as shown in the examples above.

On the one hand, an agent who knows the cause of a phenomenon could answer some kinds of what-if question because they previously understood the concepts appearing in a proposition including the concept of causation. On the other hand, an agent who understands the phenomenon could also answer the same what-if questions because they have acquired cognitive abilities. However, the what-if questions that the agent who knows the cause of p could answer are only those at a rudimentary level if they had not acquired

cognitive abilities associated with understanding-why.

4 Summary and discussions

This paper unravels the confusion of reductionists such as Sullivan [2018] and Hu [2019]. Sullivan [2018] argues that when an agent knows that q causes p via testimony, the agent must have the ability to judge if this testimony is trustworthy. However, this does not guarantee that the agent can answer the question, ‘What if q^* had happened instead of q ?’ Thus, Sullivan confuses the ability required for having propositional knowledge (an ability that the agent must have beforehand in order to know propositions) with the ability identified with understanding-why.

Hu’s argument seems more persuasive because he shows that if an agent cannot answer some what-if questions required to be answered to state that the agent understands why according to anti-reductionists, then it is also legitimate to state that the agent does not know. Nevertheless, the reason why the agent cannot answer some types of what-if questions is that the agent does not understand some of the concepts—including causation—that appear in the proposition. That is, the agent must understand what causation is (and other concepts appearing in the proposition) and have the ability to exclude some events from the candidates of causes in order to know the proposition. If the agent understands what causation is (and other concepts appearing in the proposition) and has the above mentioned ability, then it is not surprising that they can answer some rudimentary what-if questions (such as the ones Hu uses in his argument). However, this does not guarantee that they can also answer deeper what-if questions. In other words, if the agent cannot answer some rudimentary what-if questions, this means that she does not understand the concept of cause. Therefore, she cannot know the cause.

In addition, I provide in §3 a case where she does not know the cause even if she can answer a rudimentary what-if question (the car collision and cat case). This implies that the ability to answer this type of what-if question is not a constituent of knowledge of the cause (namely, this is not the ability acquired by knowing the cause) but a constituent of understanding, which is a prerequisite for having knowledge of the cause.

By contrast, for the agent to understand why the phenomenon happens, they must answer deeper kinds of what-if questions. As noted above, most reductionists and anti-reductionists accept that understanding comes in degrees. Therefore, it is reasonable to state that the agent understands why at a low level even if they cannot answer the deeper kind of what-if questions. However, notably, some what-if questions can distinguish deeper

understanding-why and mere propositional knowledge.

One such example provided in §3 is one concerning the causes of the polarity of NH_3 . Although it is certain that an agent who knows proposition (S), that the shape of the NH_3 causes its polarity, can answer some rudimentary what-if questions, there are what-if questions that she cannot answer if she does not understand why NH_3 has polarity. For example, an agent might know S, even if the agent cannot answer the question (W_S) ‘What if the shape of the NH_3 molecule is an equilateral triangle?’ However, if the agent cannot answer this question, it is legitimate to state that they do not understand why NH_3 has polarity. Furthermore, this ability to answer q_S is ability (4), which Hills says is required for understanding-why.

Providing a clear-cut standard for which level of what-if questions the agent must answer for a deeper understanding-why distinguished from mere propositional knowledge is a difficult issue. One of Sullivan’s [2018] and Hu’s [2019] achievements is that they have clarified this issue (it is difficult to clearly distinguish understanding-why and propositional knowledge). In other words, perhaps the existing suggestions anti-reductionists have proposed are insufficient even though they surely have captured the important aspects of the difference between understanding and propositional knowledge. However, a difference still remains; as shown in this paper (§3), there is a case wherein an agent does not understand why p while the agent knows the cause of p .

Their arguments also suggest that understanding is a cognitive success because of ability (Pritchard [2010], an anti-reductionist, also claims this). However, my paper seems to contradict this claim. It shows that understanding-why is epistemically valuable not because it is achieved through the agent’s abilities but because the agent acquires a new set of cognitive abilities.

It is certain that the achievements of understanding are solely epistemically valuable. However, if Alice, who knows S but does not understand why p_S , and Bob, who understands why p_S , have the exact same previous knowledge, this (Bob can understand while Alice cannot) implies that their cognitive abilities before reading the textbook are already different. It is also plausible to state that Bob’s understanding-why p_S is valuable because it is achieved by his ability, which Alice does not have.

This begs the question: What kind of ability made Bob understand why? What is the difference between abilities to achieve understanding-why and knowing propositions? Difficult issues still remain concerning the difference between understanding-why and propositional knowledge (if they are different). However, solving such issues is not the aim

of this paper. Instead, this paper has unravelled the confusion faced by reductionists.⁴

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