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Episteme, 15, 2 (2018) 183–201 © Cambridge University Press
doi:10.1017/epi.2016.54

KNOWLEDGE-HOW: INTERROGATIVES AND FREE RELATIVES

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ABSTRACT

It has been widely accepted since Stanley and Williamson (2001) that the only linguistically acceptable semantic treatments for sentences of the form 'S knows how to V' involve treating the wh-complement 'how to V' as an interrogative phrase, denoting a set of propositions. Recently a number of authors have suggested that the 'how to V' phrase denotes not a proposition, but an *object*. This view points toward a prima facie plausible non-propositional semantics for knowledge-how, which treats 'how to V' as a free relative noun phrase. In this paper I argue that the free relative semantics is implausible. I show that linguistic phenomena which seem to support a free relative semantics can be explained by the supporter of an interrogative semantics, and demonstrate that standard linguistic tests strongly suggest that 'how to V' has an interrogative reading, and no free relative reading.

INTRODUCTION

What does it take to know how to do something? Is it a matter of having propositional knowledge, or does it take some kind of non-propositional knowledge? Since Stanley and Williamson's article (henceforth S&W) (Stanley and Williamson 2001), consideration of this question has undergone a semantic ascent. Questions about the nature of knowledge-how have been displaced by questions about the semantics of sentences of the form 'S knows how to V'.[1] This ascent is typically taken to favour *Propositionalist* views, which take knowledge-how to have a propositional object, over *Non-Propositionalist* views, which take knowledge-how to have a non-propositional object.[2] A propositional account of 'S knows how to V' can be easily derived from a standard picture of wh-complements which treats 'how to V' as an *interrogative clause* denoting a *question* (Brown 1971; Stanley and Williamson 2001; Stanley 2011a, b). By contrast, Non-Propositionalists appear to face a problem of semantic implementation, since it

1 I will use single quotes to refer to sentences that are used to ascribe knowledge-how. All unquoted occurrences refer to the state of knowledge-how itself.

2 I use these labels to pick out views about the object of knowledge-how, putting to one side other commitments associated with Intellectualism and Anti-Intellectualism, concerning the relation between know-how and ability, and the metaphysical grounds of knowledge-how. Objectualism is only one species of Non-Propositionalism. Another possibility is that knowledge-how involves a knowledge relation to an activity (Hornsby 2011; Wiggins 2012).

https://doi.org/10.1017/epi.2016.54 Published online by Cambridge University Press

has been widely supposed that there just aren't any linguistically acceptable non-propositional semantics for 'knows how' ascriptions.

In this paper, I consider what I take to be the most plausible non-interrogative semantics for 'knows-how' ascriptions, which treats the 'how to V' phrase as a *free relative* noun phrase denoting an *object*. This view has been suggested by Bach (2012), and Abbott (2013: 4), but has not been subject to sustained consideration. According to a free relative semantics, sentences of the form 'S knows how to V' pick out a relation to an object, rather than a proposition. If linguistically plausible, this semantics would provide a natural way to implement Bengson and Moffett's (henceforth B&M) *Objectualist* account of knowledge-how, which claims that knowing how to do something is objectual knowledge of a way of acting (Bengson and Moffett 2011b).[3] In this paper, I will argue that on balance the free relative semantics is *not* linguistically plausible. Although B&M consider a number of linguistic phenomena that seem to suggest such a view, these phenomena can equally be explained by interrogative semantics. Furthermore, standard linguistic tests for detecting interrogative and free relative readings strongly suggest that sentences of the form 'S knows how to V' have a clear interrogative reading, and no free relative reading. The upshot is that the free relative semantics are implausible, meaning that Objectualists need to look elsewhere for a way to semantically implement their view.

The plan of action is as follows. In the first section, I lay out the distinction between Interrogative and Free Relative readings of wh-phrases. In the second section, I relate these two readings to the debate about the nature of knowledge-how, and consider some methodological issues about the relation between metaphysics and linguistic evidence. In the third section, I consider B&M's linguistic evidence that 'how to V' has an objectual reading, and in the final section I consider linguistic tests for detecting Interrogative and Free Relative readings.

1. INTERROGATIVES AND FREE RELATIVES

We can get an intuitive grip on the distinction between interrogative and free relative wh-phrases by considering the different meanings that wh-phrases can have.[4] Consider the following sentences:

(1) I asked what was for dinner.
(2) I ate what I was given.

We can give an account of the meaning of sentence (1) by reading the wh-phrase as having an interrogative meaning, denoting a question.[5] Sentence (1) is true if I utter the sentence 'what's for dinner?' (or some sentence with a similar meaning) thereby asking the question *what is for dinner?*. However, it would be wrong to treat the wh-phrase in

3 An alternative Non-Propositionalist view, which I will not have space to consider, is that knowledge-how is a knowledge relation to an action-type or activity (Hornsby 2011: 92; Wiggins 2012).

4 Standard linguistic treatments of this distinction can be found in Bresnan and Grimshaw (1978), Baker (1995) and Huddleston and Pullum (2002: 1068–79).

5 In what follows I will use single quotes for interrogative phrases, and italics for questions. On this convention the interrogative phrase 'what day is it?' denotes the question '*what day is it?*'.

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sentence (2) in the same manner. Sentence (2) doesn't claim that I ate the question *what was I given?*. Questions aren't the kinds of things we can eat. Hence, in (2) the wh-phrase 'what I was given' must denote something else, plausibly *some stuff* that I was given. Linguists standardly explain this difference in meaning by claiming that in sentence (1) the wh-phrase is functioning as an *interrogative* phrase, denoting a question, whereas in (2) the wh-phrase is functioning as a *free relative* noun phrase, denoting an object.

We can often work out how a wh-complement is functioning by considering the meaning of the embedding verb. Some verbs can relate only to questions, requiring an interrogative reading of their wh-complements, whereas other verbs can relate only to non-propositional objects, requiring a free relative reading. For example, 'ask', 'inquire' and 'wonder' can only relate to questions, whereas 'eat', 'take' and 'give' can only relate to objects.

When a verb doesn't make such a restriction in virtue of its meaning we find sentences that are ambiguous between the free relative and embedded question readings, which are helpful for seeing the distinction at issue.[6] Consider the following situation: Tariq and Mona are spies. Their job is to keep track of rival spies who are after their country's nuclear codes, and to inform their superiors whenever the rival spies attempt to communicate with their handlers. Tariq and Mona do not themselves know the nuclear codes. They are tracking two spies: Jorge and Petra. It is common knowledge between them that Petra has a belief about what the codes are, although they don't know the content of that belief, or whether it is true. Tariq utters the following sentence:

(3) Jorge knows what Petra believes.

There are two interpretations of this sentence, which have different presuppositions, and make different commitments as to the relation of Jorge and Petra.[7]

If we read 'what Petra believes' as a free relative, it denotes the thing which Petra believes – that the nuclear code is XYZ. On this reading (3) says that Jorge knows the thing that Petra merely believes: that XYZ is the nuclear code. On this reading, this sentence presupposes that Petra's belief is *true*, since Petra believes the proposition that Jorge knows, and knowledge is factive. However, this reading says nothing about Jorge's relation to Petra: they might have the same beliefs without ever having heard of one another.

By contrast, if we read 'what Petra believes' as an interrogative, it denotes a question, meaning that (3) says that Jorge knows the answer to the question of what Petra believes. This question might either be answered by a proposition like *Petra has some belief about what the nuclear code is*, or by a proposition like *Petra believes that the Nuclear codes are XYZ*. On this reading, (3) does not presuppose that Petra has a true belief, because it might be that Jorge only knows that Petra has some belief or other about the codes, without having any knowledge about what the code is. However, this sentence does require

6 For a parallel example with 'ask', see Michaelis (2011: footnote 3).

7 One way to make these readings salient is by shifting focus. Consider:
(3a) Jorge KNOWS what Petra BELIEVES
(3b) Jorge knows WHAT Petra believes
The pattern of focus in (3a) favours the free relative reading, whereas the focus in (3b) favours an interrogative reading.

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that Jorge is aware of Petra, since he cannot know that she believes such-and-such without having some idea about who she is.[8]

2. FREE RELATIVE SEMANTICS FOR 'S KNOWS HOW TO V'

Having got clear on the difference between interrogatives and free relatives, let's connect this distinction to the debate about the nature of knowledge-how. Applying the interrogative and free relative treatments to sentences of the form 'S knows how to V' gives us the following general truth conditions (with brackets used to pick out the object of the knowledge relation):

KH-INT: 'S knows how to V' is true iff for some way w, S knows [that w is a way to V].
KH-FR: 'S knows how to V' is true iff for some way w, S knows [w] and w is a way to V.

Removing the quotation marks in these semantic treatments gives us two rather different accounts of the nature of knowledge-how.[9] Disquotation on KH-INT yields the claim that knowledge-how is knowledge of a certain kind of proposition about the nature of knowledge-how. By contrast, disquotation on KH-FR yields the claim that knowledge-how is a kind of objectual knowledge of a relevant way of acting. Whereas KH-INT is a natural partner for Propositionalism; KH-FR is a natural partner for an Objectualist account of knowledge-how, as Bach (2012) and Abbott (2013) observe.

The best-developed version of Objectualism is Bengson and Moffett (2011b) (but see also Michaelson Ms). On B&M's view, knowing how to do something is objectual knowledge of a way of engaging in that activity, together with a distinctive kind of action-guiding conception of that way of acting. B&M have an ambivalent relation with the Free Relative semantics. A good deal of the evidence for their view comes from linguistic arguments which can easily be adjusted to support the free relative semantics, as we shall see in the next section. However, B&M are cagey about the connection, claiming that:

> It is not clear to what extent the *metaphysical* distinction between propositions and ways of acting currently at issue corresponds to the *linguistic* distinction between embedded questions [i.e. interrogatives] and free relatives. (Bengson and Moffett 2011b: footnote 42)

8 Sentences like (3) pose an interesting problem for Brogaard's account of knowledge-wh. She treats interrogative wh-complements and free relatives as having the same kind of meaning (Brogaard 2008:162, 2009: 449–53; Schaffer 2009: 486–91), which means she doesn't have the resources to explain sentences which are intuitively ambiguous between interrogative and free relative readings. She considers a related sentence – 'what John is is boring' (Brogaard 2008: example (30c) on 165) – but her comments do not suggest a general strategy for explaining this ambiguity.

9 In fact, KH-INT and KH-FR yield two families of views, since both leave open a number of important linguistic and philosophical issues. Both accounts leave open how to interpret the unpronounced pronoun PRO (Stanley 2011b: C3), whether the modality associated with the infinitive is deontic (Brown 1971; Besson Ms), bouletic (Bhatt 2006), or abilitative (Stanley 2011b: 126–7), what ways of acting are (Bengson and Moffett 2011b: 189–95), and what the properties of the relevant knowledge-relation are. The interrogative semantics also strictly speaking leaves open whether the wh-phrase takes a mention-all, or mention-some reading (Stanley 2011b: 183), although for simplicity KH-INT appeals to the mention-some reading.

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In the remainder of this section, I want to address B&M's worry by offering a picture of the relation between linguistic and metaphysical claims. This is controversial territory, so I will proceed carefully. I will first offer an argument for a minimal connection between the semantics for 'knows how' ascriptions and the correct account of knowledge-how, which I call the *semantic implementability constraint*. I will then distinguish this constraint from some of the other ways which Propositionalists have employed linguistic evidence, and show that this constraint doesn't face some of the worries which face these ways of using linguistic evidence. With this methodological background in place, I will answer B&M's worry, pointing out that endorsing the free relative semantics allows the Objectualist to meet the semantic implementability constraint.

I take the semantic implementability constraint to follow from the idea that the subject-matter of the debate about knowledge-how is the folk notion of knowledge-how. The line of thought goes like this. We use sentences of various natural languages to pick out states of knowledge-how. It is reasonable to assume that at least some (although certainly not all) of these sentences are true. Let's assume the English sentence 'Laura Trott knows how to cycle' is true.[10] If this sentence is true and picks out Trott's state of know-how, then the correct account of the metaphysics of Trott's state of know-how will be compatible with the correct account of the truth-conditions of this sentence. This is just an application of the truth schema – 'S' is true iff S – in the right to left direction, pointing out that the correct account of the nature of a particular piece of knowledge-how will be compatible with the correct account of the semantics of the ordinary language sentences used to pick out that state. In general terms, the semantic implementability constraint is just the idea that the correct account of knowledge-how needs to be able to give a compatible semantics for 'knows how' ascriptions.

The implementability constraint should be distinguished from some of the more controversial ways in which linguistic evidence has been used in the knowledge-how debate.

Stanley and Williamson (2001), and Stanley (2011a, 2011b) employ what one might think of as a *linguistics-first* methodology (see Devitt 2011). Whereas the semantic implementability constraint reads the truth schema from *right to left*, requiring that a metaphysical account be able to give a compatible semantics, the linguistics-first methodology reads the truth schema from *left to right*, starting with the best linguistic account of the semantics of 'knows how' ascriptions, and then reading off the compatible metaphysics. Although Stanley presents this methodology as requiring nothing more than the commitment to the truth schema (2011b: 143–9), in order to read the truth-schema in the left to right direction one needs to think that linguistic evidence somehow has methodological priority over other kinds of philosophical evidence (Brown 2013). To put the point glibly: Stanley might be right that linguists are doing metaphysics in the formal mode (2011b: 144), but the important question is whether they are doing *good* metaphysics. The semantic implementability constraint makes no commitment to the priority of linguistic evidence, since it involves reading the truth schema from right to left, meaning that it leaves open the possibility of motivating a novel semantics for 'knows how' ascriptions on non-linguistic grounds.

10 Strictly speaking, we should apply the semantic implementability constraint cross-linguistically, but this raises methodological issues beyond the scope of this paper. For the cross-linguistic data, see Rumfitt (2003), Douskos (2013) and Ditter (2016).

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Another way to appeal to linguistic evidence appeals to the linguistic uniformity between 'knows how' ascriptions and other 'knows wh' ascriptions (see Snowdon 2004: 6–8; Bengson and Moffett 2011b: 178–80; Stanley 2011a: 208). Stanley sums up this argument nicely:

> It is a common assumption between the Rylean and the Intellectualist that sentences involving constructions like "know where + infinitive", "know when + infinitive", "know why + infinitive", etc. all can be defined in terms of propositional knowledge. But given that ascriptions of knowing-how in English look so similar to such ascriptions, it is hard to see how they could ascribe a different kind of mental state. (Stanley 2011a: 208)

The idea here is that when doing linguistic analysis, we ought to expect constructions which have similar syntactic and semantic behaviour to be generated from a uniform underlying metaphysical structure. Importantly, this kind of argument is at best a ceteris paribus consideration to be fed into our theorising alongside other kinds of considerations. There are many cases in which prima facie syntactically uniform constructions pick out extremely different kinds of entities, as Michaelis observes (2011: 261–2). One reason for especially being suspicious about appeals to linguistic similarity is that there seem to be philosophical *dis*similarities between knowledge-how and knowledge-wh. Knowledge-how seems to have rather different epistemic properties to other kinds of knowledge-wh (see the discussion of justification in §3). Notice that non-linguistic dissimilarities do not cause problems for the semantic implementability constraint: if knowledge-how turns out to be a very different kind of state to other kinds of knowledge-wh, we should still want a semantics for ordinary knowledge-how ascriptions.[11]

What are the upshots of the semantic implementability constraint for Objectualism? In order to tell whether an account of the nature of knowledge-how is semantically implementable, a natural approach is to collect the semantics for 'knows how' ascriptions proposed by linguists and linguistically informed philosophers, and consider whether any of those semantics is compatible with the metaphysical account. If it turns out that an account of knowledge-how is not compatible with any off-the-shelf semantics, then this is a strike against that account, because this provides evidence that our ordinary 'knows how' ascriptions are not picking out the state posited by that account, leaving the proponent of that account open to the charge that they are changing the subject away from our ordinary notion of knowledge-how (Bengson and Moffett 2011a: 36–7). However, there are a number of ways in which the supporter of such an account might respond to this challenge. One option would be to offer a novel account of the semantics our ordinary 'knows how' ascriptions that is amenable to their metaphysics. An alternative is to opt for an error theory of our ordinary ascriptions. If our ordinary knowledge-how ascriptions are simply false, then the charge of changing the subject loses its sting.

11 One consequence of B&M's employment of a uniformity argument is that they end up committed to the claim that *all* 'knows-wh' ascriptions pick out states of objectual knowledge. I think that this view is extremely implausible (the tests detailed in §4 show that many 'knows wh' ascriptions involve interrogatives (Schaffer 2009: 486–91)). For the sake of simplicity, I will put this generalised Objectualism to one side to focus on the claim that 'knows how' ascriptions involve an object-denoting wh-phrase. An exception is that I will assume that 'knows-whether' ascriptions involve an interrogative, since I'm not even clear what it would be to claim that knowledge-whether is a kind of objectual knowledge.

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With this background in place, it is clear that the supporter of Objectualism should be in the game of finding a linguistically plausible semantics for 'knows how' ascriptions in order to implement their account. How might they do this? Obviously, S&W's preferred interrogative semantics is not compatible with an Objectualist account of knowledge-how. B&M point out that there are a number of alternatives to the interrogative semantics, citing Roberts (2009), Ginzburg (2011) and Michaelis (2011) as examples.[12] However, none of these treatments are friendly to Objectualism. Roberts (2009) builds on work by Dowty and Jacobsen to argue that infinitival how-to phrases are property-denoting verb phrases built on partition semantics, meaning that her account predicts that knowledge-how is a relation to a certain kind of goal-related property. Although Ginzburg (2011) suggests that some non-English infinitival knowledge ascriptions are non-propositional, he treats 'S knows how to V' as involving a relation to a fact. Michaelis (2011) treats wh-complements as presupposing an open proposition (of the form: *x is F*),[13] and asserting that the agent knows the unbound variable in that open proposition. Michaelis' view can sound close to Objectualism, but she explicitly claims that her account is truth-conditionally equivalent to Stanley's account (Michaelis 2011: 277), meaning that her account should not be construed as an alternative to the interrogative semantics.[14]

So from the currently available semantics for knowledge-how ascriptions, it seems that the free relative semantics is the Objectualist's best bet for directly meeting the semantic implementability constraint. As we've just noted, if the free relative semantics is not linguistically plausible, this is not a reason to outright reject Objectualism, but it does leave them either taking on the burden of developing a novel semantics, or endorsing an error theory.

3. EVIDENCE THAT 'HOW TO V' IS A FREE RELATIVE

B&M appeal to four linguistic phenomena to build an argument for thinking that the 'how to' complement in knows how ascriptions denotes an object rather than a proposition (Bengson and Moffett 2011b: 178–85):

(i) The availability of apparent objectual paraphrases for 'knows how' ascriptions,
(ii) The fact that 'knows how' ascriptions fail to take propositional modifiers,
(iii) The oddness of raising the question of justification about knowledge-how,
(iv) The gradability of 'knows how' ascriptions.

Although B&M present these phenomena as evidence for Objectualism, rather for a free relative semantics, their explanations of these phenomena are also available to the supporter of the free relative semantics. However, I don't think that these phenomena provide a compelling argument for the free relative semantics, since all of them can also be

12 See also Brown (1971) and Bhatt (2006), which stick with interrogative semantics, but offer different accounts of the modality involved.

13 On the difference between open propositions and sets of propositions, see Friedman (2013: 152–3).

14 Michaelis also makes the suggestion that what it is to know the value of a variable is to be able to find it (2011: 278). This suggests that she's committed to an ability-based account of knowledge-how. For other ability-based accounts of knowledge-wh, see Masto (2010) and Farkas (2016).

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explained by the supporter of an interrogative semantics. This is bad news for both Objectualism and free relative semantics since it removes a central plank in the case for both views.

B&M's first piece of linguistic evidence for thinking that 'how to V' denotes an object comes from the paraphrases for 'knows-how' ascriptions. They claim that the natural paraphrase for (4) is not S&W's (4a), but rather (4b):

(4) Ana knows how to swim.
(4a) Ana knows [that w is a way in which she herself can swim].
(4b) Ana knows [the way to swim].

They point out that the naturalness of (4b) is good news for the objectualist, since in this paraphrase the object of knowledge seems to be an object-denoting noun phrase – *the way to swim* – rather than a proposition-denoting that-clause. This paraphrase is also extremely close to the free relative reading of 'how to swim', suggesting that the natural paraphrase is free relative friendly.

Although this paraphrase is suggestive, a supporter of the interrogative semantics can easily explain it. 'Knowledge-the' ascriptions like (4b) plausibly have a *concealed question* reading which is equivalent to an interrogative knowledge-wh ascription (White 1982: 31–2; Brogaard 2008; Bach 2012). Consider:

(5) Jane knows the capital of Mali.

This sentence has two readings: an objectual reading which says that Jane is *acquainted* with Bamako, and a concealed question or quasi-interrogative reading which says that Jane knows *what the Capital of Mali is* but makes no commitments about acquaintance. Given the concealed question reading of 'knows-the' ascriptions it is unsurprising that interrogative knowledge-wh can be paraphrased by 'knowledge-the' ascriptions, as Pavese points out (2013, footnote 15). Taking a concealed question approach to (4b) the sentence comes out as meaning 'Ana knows what a way to swim is', which is not only an interrogative, but also pretty close to S&W's proposed paraphrase (4a).[15,16]

B&M's second piece of evidence comes from the observation that the complement in 'knows how' ascriptions fails to take modifiers that are appropriate for that-clauses. For example:

(6) Ana knows that the Prime Minister is a woman – so it must be true!

15 Jennifer Hornsby has pointed out to me that we also use ascriptions like 'Jane knows loads of ways to swim' which like (4b) suggest an objectual reading. It seems to me that ascriptions of this form are also susceptible to a concealed question analysis, despite not involving 'the'. For example 'Jane knows loads of Capitals of African Countries' has a reading which means 'Jane knows *what* the capitals of loads of African countries are.' On this treatment, 'Jane knows loads of ways to swim' would mean something like 'Jane knows *what* loads of ways to swim are'.

16 It is worth noting that whereas 'knows-the' sentences can take either a concealed question or an objectual reading, '*learns*-the' sentences like 'Joan learnt the capital of Mali' can *only* take a concealed question reading, which suggests that 'learns' cannot take an objectual complement. This is an awkward result for the objectualist, given the close conceptual connections between learning and knowing (Pavese 2016: 654–5).

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sounds fine, but:

(7) ?Ana knows how to swim – so it must be true!

Seems grammatically odd.[17] Following B&M, we might think that sentence (7) is odd because the how-complement denotes an object, and objects cannot be true. The supporter of the free relative semantics can appeal to the same explanation, since on their view 'how to swim' is an object-denoting noun-phrase.

B&M also note that 'knowledge-how' ascriptions seem not to be 'bumped up' to certainty – as knowledge-that ascriptions are – but rather seem to be bumped up to mastery:

(8) ? Ana knows how to swim – in fact, she's certain of it!
(9) Ana knows how to swim—in fact, she's mastered it!

There is a parallel argument in the offing here. The supporter of a free relative semantics can point out that one cannot be certain of ways, although one can master them.

Although these arguments initially seem appealing, they end up significantly overgenerating. It is easy to construct examples in which other kinds of 'knows-wh' ascriptions fail to take these modifiers. Consider:

(10) ? Ruth knows whether the Prime minister is a woman – so it must be true!
(11) ? Lani knows who came to the party — so it must be true.

Sentences (10) and (11) sound just as weird as (7), which suggests that if one wants to take this evidence seriously, it supports the claim that a whole swathe of 'knows wh' ascriptions have a free relative reading, which is a contentious position. B&M do float the idea that all knows-wh involves objectual knowledge (see footnote 11), so we might think that they would be happy to endorse a general free relative semantics. However, even they ought to baulk at the suggestion that 'knows-whether' ascriptions involve a free relative complement. It's difficult to even make sense of the idea that a 'whether' clause denotes an object.[18]

Furthermore, the supporter of an interrogative semantics can appeal to a fairly simple explanation for the oddness of these sentences. According to the interrogative semantics, a wh-phrase denotes not a proposition, but a *question*. And on the face of it, questions aren't the kinds of things which can be true or false.[19] So, we might think that (7), (10) and (11) are odd because of anaphora failure. The modifying phrase 'so *it* must be true' involves the anaphoric 'it', which looks back in the sentence to find something

17 I use ? to mark *grammatically* anomalous sentences. Note that a grammatically acceptable sentence can still be semantically or pragmatically odd. Some of the example sentences given below certainly are.

18 In footnote 11 I put to one side the issue of whether non-how 'knows-wh' ascriptions involve free relatives, excepting the case of 'knows-whether', which I take to be obviously propositional. In what follows I will assume that 'knows-whether' is propositional in order to test a number of arguments for the free relative semantics.

19 For example, one plausible view of questions identifies them with a partition of mutually exclusive complete answering propositions (Groenendijk and Stokhof 1984). Since a partition is not the kind of thing that can be true or false, this view can easily explain the weirdness of (7), (10) and (11).

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which might be true. Since the interrogative phrase denotes a question, one might think that the anaphoric phrase is odd because question are the only available reference for the anaphoric 'it', and questions cannot be true or false. The general lesson is that although the Propositionalist is committed to thinking that 'knowledge-wh' ascriptions are made true by states of propositional knowledge, they don't need to think that 'knows-that' and 'knows-wh' ascriptions have precisely the same semantic or syntactic properties.[20]

The supporter of an interrogative semantics can also explain the appropriateness of (9). Presumably one can master *activities* as well as ways of acting. And, on the standard interrogative semantics, (9) relates Ana to a question about the activity of *swimming*. So on the standard interrogative semantics for (9) the first part of the sentence includes a term picking out an activity which can be the subject of anaphoric reference in phrases like 'in fact, she's mastered it'.

Examples like (8) involving 'in fact, she's certain of it' are a little trickier to deal with. Intuitively, one *can* be certain of questions – consider 'Paul was certain of who came to the party' – so the interrogative semantics predicts that these sentences ought to be acceptable. Interestingly, the parallel examples for 'knows-whether' are a little strange but seem grammatically acceptable. For example:

(12) Ruth knows whether the Prime Minister is a woman – in fact she's certain of it!

sounds fine. This sentence says that Ruth doesn't merely know, but is certain of whether the PM is a woman. Pretty much all of the examples here are controversial, but I think there are some 'knows how' sentences involving certainty which seem grammatically acceptable. For example:

(13) Ana knows how to pronounce 'phở' – in fact she's certain of it!

Sounds grammatically acceptable to me: it says that Ana doesn't merely know, but is certain of how to pronounce 'phở'.[21] There's certainly room for disagreement about the acceptability of this sentence, and I can easily imagine supporters of the free relative semantic contending sticking to their guns, and claiming that (13) is unacceptable.

20 B&M consider this kind of response (Bengson and Moffett 2011b: footnote 43). They point out that this explanation predicts that anaphora with predicates of questions (like: 'it is easily answered', 'it is a difficult question', or 'it is extremely interesting') ought to be acceptable. They give an example of this kind of anaphora which seems bad:

(1) ? Michael knows how to swim; it is easily answered

However, there are other examples which seem grammatically acceptable, although baroque:

(2) Xenia knows how to solve the puzzle; although it is a difficult question.

(3) Paula knows how to prove the ABC conjecture; it is extremely interesting.

It is also worth noting that part of the oddness of (1) might well come from the fact that *how to swim* is not an easy question, which is a semantic rather than a grammatical issue with the sentence.

21 Incidentally, (13) sounds even better to me if we omit the final 'of it':

(13a) Ana knows how to pronounce 'phở' – in fact she's certain!

I should note that an anonymous reviewer has reported opposing intuitions about (13a), underlining the trickiness of relying on intuitions about grammaticality in this area (see below).

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However, if there is disagreement about our intuitions, this is bad news for the supporter of free relative semantics. If there are conflicting or fuzzy intuitions about the acceptability of a class of sentences, then neither side of the debate ought to be relying on the acceptability (or unacceptability) of these sentences as motivation for their view, which means that examples like (8), (12) and (13) are not admissible evidence for either side.

B&M's third piece of evidence is the fact that 'knows-how' ascriptions do not open up the question of justification, unlike 'knows-that' ascriptions (Austin 1956). They point to the following exchange:

(14) (a) Martin knows how to get to the airport,
(b) Hmmm ... is he really justified in believing that?

The response in (14b) is certainly odd, and one might think that this is because knowledge-how is not the kind of knowledge which involves justification.

However, the supporter of an interrogative semantics can explain the oddness of this exchange by appealing to the same kind of anaphora failure which occurs in sentence (7), (8), (10) and (11). The response in (14b) involves an anaphoric 'that' which looks for a proposition in (14a) about which one can raise the question of justification. However, if the interrogative semantics is correct, then (14a) ascribes knowledge of a question, meaning that there are no propositions available for the anaphoric 'that' to pick up on. Consider a parallel example with 'knows-whether':

(15) (a) Martin knows whether to swim
(b) Hmmm ... is he really justified in believing that?

The response in (15b) is just as weird as (14b), suggesting that the oddness stems from problems with anaphoric reference to interrogative phrases, rather than any special features of 'how to V' phrases.

Putting the oddness of (14b) to one side, one might think that there remains a powerful non-linguistic argument for Objectualism in the offing here. It seems that there are many cases in which agents know how without having a related justified belief (Cath 2011; Glick 2011: 408–9; Weatherson 2016: 12–13). Since most theories of the propositional knowledge relation claim that it requires justification, one might take the observation that we seem to have here a case of knowledge-how without justification as evidence that the relation involved in knowledge-how is something other than propositional knowledge. In particular, one might take this as an argument for thinking that knowledge-how is non-justification entailing *objectual* knowledge. This is an instance of a wider class of arguments which we might call *divergence arguments*, which are most familiar from the debate about the Gettierisability of knowledge-how (Poston 2009; Cath 2011, 2015; Carter and Pritchard 2015). These arguments contend that knowledge-how cannot be a kind of knowledge-that because the two kinds of knowledge have different epistemic properties.

A successful divergence argument establishes that knowledge-how involves a relation with different epistemic properties to standard examples of knowledge-that. However this result doesn't establish that the object of knowledge-how is anything other than a proposition. Supposing that knowledge-how does not entail justification, it might be the case that knowledge-how is a special kind of non-justification-entailing propositional

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knowledge, or that knowledge-how is a non-knowledge constituting relation to a proposition.[22] Although positing that knowledge-how is a kind of non-justification entailing propositional knowledge seems rather ad hoc, there are various accounts of propositional knowledge on the market which claim that propositional knowledge does not require justification (Goldman 1967; Kornblith 2008).[23] So, even if the divergence argument for justification goes through, it does not establish that the object of knowledge-how is anything other than a proposition.

B&M's final piece of evidence comes from the apparent gradability of 'knows-how' ascriptions. We can say one person knows how to do something *better* than someone else, or that they know *in part* how to do something. These qualitative and quantitative modifiers don't apply to 'knows that' ascriptions, suggesting that know-how, but not know-that, can come in degrees (Ryle 2009: 46). A free relative semantics is in a nice place to explain these data, since objectual knowledge ascriptions also permit degree modifiers – one can have partial knowledge of Paris, or know Paris better than someone else. These modifiers can be neatly explained by pointing out that one can be more or less acquainted with an object, suggesting that these modifiers grade the knowledge-how *relation*.

However, a supporter of Interrogative semantics can also provide plausible explanations for the gradability of knowledge-how ascriptions, positing that these modifiers attach to the *object* of knowledge-how. For example, Stanley treats comparative modifiers like *better than* as grading the quality of the ways known (2011b: 31–5) and Pavese argues that degree modifiers like 'in part' mark a partial answer to the embedded question (Pavese 2013, 2017) (see also Roberts 2009). The upshot is that both Objectualism and Propositionalism can explain the gradability of 'knows how' ascriptions, although Objectualism posits a modification of the knowledge relation, and Propositionalism a modification of the objects of knowledge.

To sum up, the four linguistic phenomena that B&M appeal to in support of Objectualism are suggestive of a free relative semantics, although closer attention shows us that a supporter of interrogative semantics can also explain these features, meaning that the ability to explain these linguistic phenomena is not a reason to prefer a free relative semantics over an interrogative semantics.

4. TESTS FOR DISTINGUISHING FREE RELATIVES FROM INTERROGATIVES

There are a number of linguistic tests which can be used to determine whether a 'knows wh' ascription has an interrogative or free relative reading (Schaffer 2009: 486–91). These tests pose a serious problem for the free relative semantics for 'know-how', since 'S knows how to V' systematically tests positive for an interrogative reading and negative for a free relative reading.

There are five tests for detecting an interrogative reading of a wh-phrase:

22 Both of these moves are somewhat controversial, but are represented in the literature. For the analogue moves in the Gettierisability debate, see Cath (2015) and Cath (2011) respectively.

23 It is worth pointing out that sections 7.2. and 7.3. of *Know How* are effectively an extended version of this style of response to various divergence arguments. See Stanley (2011b: 166–7).

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(i) *Wh-the-hell*: If the wh-phrase can be extended to an exclamation like wh-the-hell then it has an interrogative reading (Zwicky and Sadock 1975).
(ii) *Co-ordination*: If the wh-phrase can be embedded within a verb which only accepts interrogative complements – like 'wonder', 'ask' or 'inquire' – then it has an interrogative reading (Bresnan and Grimshaw 1978: 332; Baker 1995: 204–7).
(iii) *Multiple questions:* If the wh-phrase can be extended to include multiple question-words, then it has an interrogative reading (Baker 1968; Bresnan and Grimshaw 1978: 335).
(iv) *Paraphrase*: If the wh-phrase involves, or can be paraphrased by, a question-word that cannot take a free relative reading, then it has an interrogative reading (Baker 1995: 217).
(v) *Infinitive*: If the wh-phrase is infinitival, then it is an interrogative, and *not a free relative* (Baker 1995: 216–18; Huddleston and Pullum 2002: 1070–3).

A couple of points about these tests. First, the tests merely detect a reading of a wh-phrase, so testing positive for one reading doesn't establish that the other reading is not available. Some wh-phrases are ambiguous between interrogative and free relative readings (as we saw with sentence (3)). The exception to this is test (v), which *does* tell against a free relative reading. Second, passing a test is a *sufficient* condition for a reading, but not a necessary condition. Failing one test is not a guarantee of the absence of a particular reading: for example finite wh-phrases do not pass (v), but will pass all of the other tests for an interrogative reading. However, if a wh-phrase fails *all* of the tests for a reading, I take this to be good evidence that that reading is not present. Third, these tests detect readings of a given wh-phrase independently of the embedding verb. There may be sentences in which a wh-phrase can have two readings, but the embedding verb forces one of those readings (such as sentence (2)).

A typical know-how ascription – 'Ruth knows how to get to Larissa' – gives clearly positive results on tests (i), (ii) and (v). Tests (iii) and (iv) do not give clear positives, but don't cause serious problems for the interrogative semantics.

The wh-the-hell test (i) suggests an interrogative reading, since:

(16) I don't know how the hell to get to Larissa

is an acceptable sentence.

The co-ordination test (ii) also suggests an interrogative reading, since 'how to get to Larissa' can be moved into verbs that can only accept interrogative complements. Consider:

(17) Ruth wondered how to get to Larissa.
(18) Ruth asked how to get to Larissa.
(19) Ruth inquired how to get to Larissa.

All of these sentences are completely acceptable.

Whereas the patterning of the data on tests (i) and (ii) is robust, with all 'knows how' ascriptions passing these tests, the multiple question test (iii) is less decisive. We can find some examples of infinitival how ascriptions with multiple question words. For example:

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(20) Ruth knows how to get to where.
(21) Ruth knows how to get to whom.

However such examples are few and far between, and seem to be of doubtful acceptability. I don't think that the rarity of multiple questions ought to be too much of a worry for an interrogative treatment. For one thing, these tests provide merely sufficient conditions for an interrogative reading. Furthermore, it is just as difficult to find multiple question examples for 'who to', 'where to' and 'whether to', suggesting that the underlying pattern is that it is difficult to construct multiple wh-phrase for sentences involving *infinitival* wh-phrases.

The paraphrase test (iv) is based on the observation that different question-words seem to be more or less favourable to the free relative reading, with 'whether' never taking a free relative reading.[24] We might try to paraphrase 'Ruth knows how to get to Larissa' with a 'knows-whether' ascription. Consider:

(22) Ruth knows whether taking the road north is the way to get to Larissa.

However, this does not seem like a particularly successful paraphrase for the original sentence. Again, because these tests provide sufficient conditions for an interrogative reading, the doubtfulness of this paraphrase is not a serious worry for the supporter of an interrogative reading.

The infinitive test (v) is crucial, since it both supports an interrogative reading, and speaks against a free relative reading. We have seen (from example (3)) that 'knows' can take both interrogatives and free relatives. However, when it comes to embedded infinitival wh-phrases we can only seem to detect interrogative readings. The sentences:

(23) Ruth knows when to turn off the road.
(24) Ruth knows why to take the high road to Larissa.
(25) Ruth knows whether to start off early or late.

seem only to mean that Ruth knows the propositions which answer the various indirect questions, and do not have objectual readings.[25] Additionally verbs that can only take free relative wh-phrases – like 'take', 'ate' and 'gave' – cannot be combined with an infinitival wh-phrase. Consider:

(26) ? Jane took what to use for cleaning the board.
(27) ? John ate what to eat.
(28) ? Amy gave what to use to write on the board.

24 As incidental support of the line that 'knows how' does not involve a free relative, it is worth noting that some linguists class 'how' along with 'whether' as a question-word which can *never* take a free relative reading (Baker 1995: 217; Huddleston and Pullum 2002: 1072). This claim is too strong (for example, 'I was upset because of how he acted' pretty clearly involves a free relative, and 'How she writes is unclear' seems ambiguous between free relative and interrogative readings), but the fact that a number of prominent linguists have made this claim is indicative of how rare it is to find clear examples of 'how' functioning as a free relative.

25 We shouldn't be misled by the 'knows-the' paraphrases for these sentences, which will involve a concealed question reading (see section 3).

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Since there are no good examples of infinitival wh-phrases with a free relative reading, test (v) both strongly suggests an interrogative reading of 'S knows how to V', and speaks against a free relative reading.

Let's take stock. The results of tests (i), (ii) and (v) strongly suggest the availability of an interrogative reading for sentences of the form 'S knows how to V', and test (v) also speaks against a free relative reading. Tests (iii) and (iv) are not so decisive, but in the context of the positive results on the other tests these failures do not speak against the interrogative reading.

This means that the simple view according to which 'how to V' always functions as a free relative in 'knows how' ascriptions is implausible. There are two ways in which the supporter of the free relative semantics might respond to these results: to argue that the free relative reading holds true for some sub-set of 'knows how' ascriptions, or to argue that 'knows how' ascriptions are ambiguous between the two readings.

The first move restricts attention to a sub-set of 'knows how', and suggest that some 'knows-how' ascriptions are interrogatives and others free relatives. Although it is true that the philosophically interesting class of knowledge-how is not just all knowledge picked out with a how-complement, the most plausible way to linguistically delimit the philosophically interesting kind of know-how is to focus on 'S knows how to V' (Hornsby 1980: 84; Glick 2011: 427; Wiggins 2012), which test (v) suggests is an especially implausible candidate for a free relative reading.[26] A more plausible move would be to appeal to ambiguity, claiming that 'knows how' has both interrogative and free relative readings, like sentence (3). This kind of view could explain the positive results on tests (i) and (ii) since if 'know-how' were ambiguous, the addition of interrogative modifiers or embedding within a verb like 'wonder' would force the interrogative reading.

However, the ambiguity view runs into serious problems. For one thing, test (v) speaks both for the interrogative reading, and against the free relative reading. It is also worth noting that B&M have themselves pointed out that 'knows how' fails standard tests for ambiguity (Bengson and Moffett 2007: 38–40; Bengson *et al.* 2009: 393–4). Furthermore, the standard tests for a free relative reading come up negative, suggesting that there is no available free relative reading. There are two tests for a free relative reading:

(vi) *Wh-ever*: If the wh-word can be extended to wh-ever, then the wh-phrase is a free relative (Bresnan and Grimshaw 1978: 334–5; Huddleston and Pullum 2002: 986–7).

(vii) *Co-ordination:* if the wh-phrase can be combined with a verb which cannot take an interrogative complement – like 'took', 'believes' or 'ate' – then it has a free relative reading (Bresnan and Grimshaw 1978: 332; Baker 1995: 204–7).

Test (vi) gives a negative result for a free relative reading. Sentences of the form:

(29) ? Ruth knows however to get to Larissa.

26 Perhaps finite 'knows how' ascriptions might provide better case for a free relative reading. For example, 'Jane knows how coffee smells', seems at least on one reading to denote a kind of acquaintance knowledge (Moore 1997: 183), and actually passes test (vi) for a free relative reading. Since these ascriptions do not ascribe the practical species of knowledge-how, the existence of a free relative reading of these sentences is incidental to our main concern here.

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are not acceptable.

The co-ordination test with 'believes' (vii) also brings bad news. If the ambiguity story were correct, we would expect that 'how to V' could combine with 'believes', and other predicates which cannot embedded interrogatives. Consider:

(30) ? Ruth believes how to get to Larissa.

The weirdness of this result seems to reconfirm Ryle's observation that we don't believe-how (Ryle 2009:17).[27]

Kent Bach (2012) suggests an extension of this test, claiming that 'practice', 'demonstrate' and 'perfect' cannot relate to propositions, meaning that the fact that these verbs can embed 'how to V' provides evidence for a free relative reading. It is certainly true that 'practice', 'demonstrate' and 'perfect' cannot take that-clauses as their objects.[28] However, if we look a little closer at the wh-phrases that can embed in these verbs, it becomes clear that they can embed interrogatives (see Pavese 2013: footnote 15). These verbs can take infinitival wh-phrases, 'whether' questions and multiple questions, which we have seen above can only be interrogatives:

(31) Mark practiced what to say.
(32) Jane demonstrated whether to use 'less' or 'fewer' in the example sentences.[29]
(33) Ana perfected what to do when.

The acceptability of (31), (32) and (33) suggests that these verbs can take interrogatives, meaning that the fact that 'how to V' can embed in them does not provide evidence for a free relative reading.

As I noted above, the failure to pass all of the tests for a given reading provides strong evidence that that reading is not present, meaning that the failure of 'S knows how to V' to pass (vi) and (vii) gives us strong evidence that it has *no* free relative reading. Together with test (v) this establishes a strong case against the suggestion that 'S knows how to V' has a free relative reading. I conclude that the how-complement in 'S knows how to V' can take an interrogative reading, but not a free relative reading.

27 Stanley suggests that 'believes' cannot take 'how to V' because it cannot ever take interrogative complements (2011b: 33). This conjecture seems false. There are examples of the form 'I could hardly believe …', which seem to involve genuine interrogatives. If I say, 'I could hardly believe what he was wearing', it isn't the clothes, but *that* he was wearing them which is difficult to believe (Glick 2011: footnote 9). Although this fact somewhat undermines the significance of the 'believes' data, it remains true (i) that putting the special 'could hardly' context to one side 'believes' *can* embed free relative clauses, such as 'what he said' but not 'how to' clauses, and (ii) other verbs which select for a free relative reading – such as 'ate', and 'took' do not embed 'how to' clauses. Thanks to Ephraim Glick for discussion.

28 A caveat: one can demonstrate that p, but only with the sense which means 'establish', which is not at issue here.

29 Note that even if one is doubtful about (32), 'demonstrate' can take both infinitival wh-phrases, and multiple wh-phrases.

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5. CONCLUSION

Although a free relative semantics for knowledge-how ascriptions initially appears to be an attractive way to semantically implement a non-propositional account of knowledge-how, on balance this semantic account is linguistically implausible. The linguistic data which B&M point to, although suggestive, can also be explained by the standard interrogative semantics. Furthermore, standard linguistic tests suggest that sentences of the form 'S knows how to V' have an interrogative reading, and no free relative reading. The linguistic implausibility of this view means that an Objectualist metaphysics needs to look elsewhere to semantically implement their account. In §2 I suggested that they have two options: to develop a novel semantics which is compatible with their view, or to endorse an error theory according to which ordinary sentences of English do not pick out states of knowledge-how.[30]

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30 Thanks to Fatema Amijee, Matthew Cameron, Katherine Hawley, Jennifer Hornsby, Matthew McKeever, Eliot Michaelson and Fenner Tanswell, and an anonymous referee for this journal for extremely helpful comments. Special thanks to Ephraim Glick for suggesting the central idea of this paper. This research was supported by a United Kingdom Arts and Humanities Research Council doctoral scholarship.

https://doi.org/10.1017/epi.2016.54 Published online by Cambridge University Press

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https://doi.org/10.1017/epi.2016.54 Published online by Cambridge University Press

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