

Group Knowledge, Questions, and the Division of Epistemic Labour

Joshua Habgood-Coote
Department of Philosophy, University of Bristol

Abstract

Discussions of group knowledge typically focus on whether a group's knowledge that p reduces to group members' knowledge that p . Drawing on the cumulative reading of collective knowledge ascriptions and considerations about the importance of the division of epistemic labour, I argue what I call the Fragmented Knowledge account, which allows for more complex relations between individual and collective knowledge. According to this account, a group can know an answer to a question in virtue of members of the group knowing parts of that answer, when the whole answer is available to group-level action. I argue that this account explains a swathe of central cases of group knowledge, as well as explaining some central features of group knowledge.

Introduction

What is the relationship between the knowledge had the members of a group, and the knowledge had by the group as a collective entity? Recent debates in social epistemology have focused on the question of whether a group's knowing something requires some member of that group knowing or believing it.¹ This debate assumes that if there is an interesting relation between individual and group knowledge, it holds between individual and group-level attitudes to the same proposition.

In this paper, I develop an account of group knowledge that allows for a more complicated relation between individual and group knowledge. This picture is motivated by consideration of cases involving the division of epistemic labour, whereby a group deals with a complex body of information by dividing it into parts and assigning those parts to different

¹ See (Hardwig 1985; Kitcher 1991; Thagard 1997; Tuomela 2004; List 2005; Wray 2007; Rolin 2008; Bird 2010; 2014; Fagan 2011, 2012, 2014; De Ridder 2014; Lackey 2014; Miller 2015; Klausen 2015).

members.² I will argue that we can understand these cases by appealing to the part-whole structure of a question. Roughly speaking, the core idea is that a group can know an answer to a question in virtue of the members of that group knowing the various parts of that answer. The full account combines distributed knowledge of the parts of an answer to a question with a requirement that this knowledge is accessible to group-level action, giving us the following account of group knowledge:

FRAGMENTED KNOWLEDGE: A group can know an answer to a question, when the individual members of that group know a set of partial answers which combine to yield a complete answer, and the complete answer is available to group-level action.³

I intend this account as a sufficient condition for group knowledge, but I don't want to commit to the corresponding necessity claim. Group mentality and our talk and thought about collective entities are complex topics, and there may well be several different ways in which we might explicate the concept of group knowledge (de Ridder 2019) which might be useful for different purposes, or for different kinds of groups. In part, my project is ameliorative: I hope to make the case that the Fragmented Knowledge account provides a productive and useful way to think about the epistemic lives of various different kinds of groups.⁴ In particular, I argue that this account is well-suited for making sense of the knowledge had by groups with developed internal structures and procedures,⁵ that it makes sense of the way we use collective knowledge ascriptions to explain and predict collective actions, and that it makes plausible predictions about the epistemic permissibility of collective actions and intentions.

The plan of action is as follows. In section 1 I lay out the core cases of the division of epistemic labour, and in section 2 I argue that none of the

² For classic discussions of the division of practical labour, see (Smith 1776) and (Durkheim 1893). Modern literature typically uses the phrase 'the division of labour' to refer to a Smithian phenomenon of scientific competition (Kitcher 1990; Strevens 2003; Weisberg and Muldoon 2009; Weisberg 2010; Zollman 2010), or to refer to a kind of epistemic dependence (Goldberg 2010). I will use the phrase to refer to the phenomenon in Smith's original example: co-operation within a team with diverse skills (see Muldoon 2018).

³ See (Boddy 2014; Baltag, Boddy and Smets 2018) for discussions of group knowledge that employ similar formal tools.

⁴ Throughout, 'group' and 'collective' will be used equivalently as umbrella terms for any agent partly or completely composed of individual agents.

⁵ In section 5 I will consider unstructured groups, suggesting that although they cannot have fully-fledged collective knowledge, they can have collective propositional justification.

established accounts of group knowledge can make sense of these cases. In section 3 I lay out a framework for thinking about questions, focusing on their the part-whole structure, and in section 4 I show how tools from this framework help us to think about the division of epistemic labour. In section 5, I use these tools to formulate the Fragmented Knowledge account, starting with a simple account, before motivating the requirement that partial knowledge be available to collective action. In closing we consider some upshots of the account, and respond to some potential worries.

A couple of clarificatory points.

For presentational purposes I will be assuming that both knowledge-wh, and knowledge-how involve knowing propositions. There is a lively debate about the propositionality of knowledge-wh and knowledge-how (Parent 2014; Fantl 2009; Bengson and Moffett 2011a; Cath 2019). Although a propositional picture of knowledge-wh has fairly wide support, a propositional picture of knowledge-how is extremely controversial. Taking on the assumption of propositionality massively simplifies our presentation, allowing us to use the same machinery to make sense of the division of labour involved in knowledge-that, knowledge-wh, and knowledge-how. However, this assumption is not required for the success of the Fragmented Knowledge account. The central claim of this account concerns the relation between individual and group-level knowledge, meaning that it is neutral on how to understand individual knowledge. The core idea of this account is that a group can know something in virtue of its members knowing the parts of that thing. This idea can be filled out in different ways depending on how we understand knowledge, the kinds of things that we can know, and the different kinds of part-whole structures had by the objects of knowledge.⁶

The inspiration for the Fragmented Knowledge account comes from discussions of what linguists call the cumulative – or sometimes the semi-distributive – reading of collective knowledge-wh ascriptions. In fact, our first pass at an account of collective knowledge (FRAGMENTED KNOWLEDGE 1) is extremely close to Uptal Lahiri’s semantics for this reading (Lahiri 2002: C4). The fact that the account takes inspiration from formal semantics raises the difficult question of the proper relation between ontology and formal semantics. This question has been discussed both in relation to knowledge-how (Stanley and Williamson 2001, Noë 2005, Devitt 2011, Glick 2011, Stanley 2011), and social ontology (Ritchie 2016, 2018).

⁶ See section 5.6 for a discussion of how this account might be tweaked for a non-propositional account of knowledge-how.

Some authors seem to treat linguistic evidence as providing conclusive answers to philosophical questions, taking what (Devitt 2011) calls a linguistics-first approach. We don't need to rely on this methodology to make use of linguistic evidence in philosophy. The Fragmented Knowledge certainly takes inspiration from semantics, but I think that it should be assessed on the basis of both linguistic and philosophical considerations.⁷

§1 The Division of Epistemic Labour

In this section, I set out three cases of in which a group possesses knowledge in virtue of knowledge distributed its members.⁸ These are divergence cases, in the sense that the groups in these examples each know propositions which none of their members do. The three cases I consider cover different kinds of knowledge (how, wh, and that), and as we shall see in section 4 provide examples of different ways in which answers to sub-questions can combine.

Our first case comes from (Bird 2010: 33-4):

NASA: NASA has formed a plan to build a space shuttle. This is a complicated process, involving a number of tasks which draw on specialised knowledge. In order to build the shuttle efficiently, the planning committee splits the task into various sub-tasks, and assigns specialists to each of these tasks. A programmer is assigned to design the software; a chemist to make up the fuel; an aeronautical engineer to build the fuselage, and so on. Each of the specialists has a good deal of knowledge about how to perform their task, but none of them has any knowledge about any of the other sub-tasks. Nonetheless, the team of specialists does an excellent job, and the space shuttle is successfully made.

In this case, sentences 1) and 2) both seem true:

- 1) NASA knows how to make a space shuttle.

⁷ For an argument for this attitude toward linguistic evidence in the knowledge-how debate, see (Habgood-Coote 2018b).

⁸ For cases with similar structures, see Tollefsen's UN population case (Tollefsen 2007; Lackey 2012, 2014), Bird's interdisciplinary modus ponens case (Bird 2010: 34-35), Hutchins's discussion of the USS Palau (Hutchins 1995), Knorr Cetina's discussion of the high-energy physics community (Knorr Cetina 1999) and the cases of radical collaboration in (Kukla 2012; Winsberg, Huebner, and Kukla 2014; Huebner, Kukla, and Winsberg 2018)

- 2) No-one in NASA knows how to make a space shuttle.

This pair of judgements is intuitively plausible, and is backed up by surveys of non-philosophers' intuitions (Jenkins et al 2014).^o

Our second cases involves knowledge-who:

PARTY: The members of the Rowing Club are hosting a party in their club-house, and have decided each member of the club will stay in a one of the rooms in the club-house for the whole night to ensure that none gets trashed. Each person who visited the party visits at least one of the rooms, and introduces themselves to the club-member in that room, but none of the rooms was visited by all the party-goers. Each of the club members has an excellent memory, and remembers the names of everyone who they met.

This case supports a similar pair of divergent judgements, expressed by 3) and 4):

- 3) The Rowing Club knows who came to the party.
- 4) None of the members of the Rowing Club knows who came to the party.

Our third case is adapted from an example that comes from Roger Schwartzschild via Uptal Lahiri (Lahiri 2002: 189-90), and involves both knowledge-whether and knowledge-that:

LITTER: The members of a scout group are carrying out a project about littering, and have decided to investigate whether there is any litter on a local bike path. The path is a couple of miles long, so the group splits up, with each member searching one section of the path,

^o (Jenkins et al 2014) presented 116 participants with a case like NASA, and considered whether participants ascribed knowledge to the group, and to its members. Although they don't report results specifically for this case, we can isolate responses to this case, and run the same tests as they do. A one-way ANOVA revealed a significant effect of question condition on responses for this single case, $F(2, 115) = 97.81, p < .001, \eta^2 = .63$. Tukey's posthoc tests showed that on a 1 to 7 scale (1 low, 7 high) participants agreed more with ascriptions in the group-level condition (condition two, which is equivalent to sentence 1) ($M = 6.48, SD = 1.24$) than in either the 'each member' question condition (condition three) ($M = 1.68, SD = 1.19$), $p < .001$, or the 'any member' question condition (condition one, which is equivalent to the negation of sentence 2) ($M = 3.10, SD = 2.07$), $p < .001$. This suggests that in cases like NASA the folk are willing to ascribe knowledge to the group, while not ascribing knowledge to its members.

noting down if they see any rubbish. In fact the path is litter-free, and each of the scouts searches their part of the path in vain.

In this case, we can formulate divergence judgements using both knowledge-whether and knowledge-that. Consider the following pairs of sentences uttered at a time between the information having been gathered and everyone reporting their results:

- 5) The scouts know whether the whole path is litter-free.
- 6) None of the scouts knows whether the whole path is litter free.

- 7) The scouts know that the path is litter-free.
- 8) None of the scouts know that the whole path is litter-free.¹⁰

As a group, the scouts seem to have knowledge-whether and knowledge-that which goes beyond that possessed by any individual scout.

I suggest that we should take the divergence judgements in NASA, PARTY, and LITTER seriously. Although we do sometimes mistakenly ascribe knowledge to groups when the groups are really in a position to know the propositions in question (Lackey 2014: 294-5), considerations of the explanatory and normative role of knowledge supports the claim that these are genuine cases of collective knowledge.

Sentences 1), 3), 5), and 7) predict and explain the actions of the groups in the ways distinctive of knowledge in the individual case. We might appeal to NASA's know-how to predict that it will successfully make a shuttle, or appeal to the scout group's knowledge about whether the path is litter free to predict whether it will keep scouring the path. These sentences can also be used to flag the respective groups as informants, which is a central function of knowledge ascriptions (Craig 1990). If the police were rounding up partygoers, it would be natural for a police officer to say:

¹⁰ One might take issue with the claim that the scouts know whether the path was litter free before they share their results. Until the results are announced, we might think that the group is merely in a position to know whether the path was litter-free (Lackey 2014). One might motivate this move by arguing group knowledge requires some kind of joint commitment to the proposition in question. Although there might be a perfectly good sense of collective knowledge has this requirement, the considerations below about the explanatory and predictive roles of knowledge ascriptions below suggest that there is also a good sense in which the group does know the answer to this question before its members pool their results.

10) Let's get the Rowing Club in; they know who came to the party,

The ascriptions of knowledge to the groups also predict the appropriateness of collective action, assertion, and intention (Hawthorne and Stanley 2005; Williamson 2000; Habgood-Coote 2018a). NASA could rationally form an intention to make a space shuttle, the Rowing Club would be acting with epistemic propriety if it gave a statement about who was at the party that drew on its members' knowledge, and the scout group would be acting with epistemic propriety if it claimed the council reward for having a litter-free cycle path on the basis of its members' knowledge.¹¹

It is also difficult to take issue with the denial of knowledge to the members of the groups. In NASA we can truly say things like 'the chemist knows how to make a space shuttle,' but only in a sense that expresses very coarse-grained and general knowledge which falls far short of the practical knowledge which we are supposing is possessed by the group.¹² If we focus on the relatively demanding readings of the knowledge ascribed to the groups, it should be clear that the members of the group do not know what the group does.

What lessons might we draw from these cases?

The modest lesson is that these cases demonstrate the importance of what linguists call the cumulative reading of group knowledge ascriptions. Whereas a distributive reading of a predicate ascribes a property to all of the members of a group, and a collective reading ascribes the predicate to the group collectively, the cumulative reading claims that the various members of the group contribute to the collective fulfilling the predicate such that between them the predicate fully obtains.¹³ When linguists discuss sentences like 1), 3), 5), and 7) they seem to have the modest lesson in mind.

¹¹ For the significance of the qualifications about the basis of action, see section 5.7.

¹² We get a similar phenomenon if we focus on the mention-some reading of 'who came to the party' in 4).

¹³ To get a grip on the cumulative reading, consider:

1) Four linguists wrote three books.

On the collective reading, the four linguists jointly wrote three books. On the distributive reading, each of the four linguists wrote three books. On the cumulative reading, there is some way to combine the linguists as authors or co-authors such that between them the number of books that they wrote is three (say, if three co-wrote one book, and the other the other two). For discussion of this reading in linguistics, see (Scha 1981; Landman 1989; Gillon 1992; Schwarzschild

The ambitious lesson is that these cases instantiate an important feature of collective knowledge: the division of epistemic labour.¹⁴ A central feature of collective agents is their ability to deal with complex tasks by splitting them into simpler tasks that can be performed more efficiently by individuals with the appropriate skills. For example, NASA can deal with the task of making a space shuttle by splitting it up into simpler tasks like making the fuselage and concocting the fuel. We might think this division of labour carries across into the epistemic realm, and that the cumulative reading of knowledge ascriptions picks out the kind of knowledge which is its consequences. This point is easiest to see in the case of collective inquiry: a collective agent can perform the task of coming to know something by different members coming to know suitably related smaller things.

If we draw the modest lesson, what we want is an account of the kind of knowledge picked out by the cumulative reading of collective knowledge ascriptions, which we can treat as a linguistic curio. By contrast, if we draw the ambitious lesson, these cases demonstrate an important structural feature of collective knowledge which we will want to build in to our account of collective knowledge. I will draw the ambitious lesson, but if for some reason the general account of group knowledge turns out to be incorrect, then what I say below can be repurposed as an account of the cumulative reading of group knowledge ascriptions.

§2 Explaining the Division of Labour

There are various accounts of group knowledge available in the literature. In this section I argue that none of them can offer a compelling explanation of cases like NASA, PARTY, and LITTER, or the division of labour that they exhibit.

1996; Lahiri 2002: 184-220), and for discussions in philosophy see (Dever 1991; Oliver and Smiley 2008; Linnebo and Nicholas 2008; Cotnoir 2013: 308-11; Ludwig 2016: C10 note 25).

¹⁴ To make things simpler, I have focused on cases where the division of labour is formalized by the group's organizational structure. Cases where a division of labour is implemented in a less formal way – think of the invisible hand of the market (Hayek 1945), competition in science (Strevens 2003), or the contingencies of social position (Collins 2000) – will be much more complicated. These cases will potentially run afoul of the accessibility to collective action condition—presumably the invisible hand acts only in a metaphorical sense—but we can still use the machinery of questions and subquestions to think about the epistemic potential of these groups (see section 5.4).

A central question for accounts of group knowledge is whether they endorse the following principle:

SUM_{KNOW} : A group G knows that p only if at least one member of G knows that p

Following convention, we can call accounts that endorse SUM_{KNOW} Summativist, and accounts that deny it Non-Summativist.¹⁵

Summativist accounts cannot explain the presence of group knowledge in NASA, PARTY, and LITTER. These are cases in which a group knows something which no member of the group knows. In fact, we could easily tweak NASA, PARTY, and LITTER so that no member of the group had any attitude toward the proposition known by the group. It wouldn't be particularly odd if the members of NASA had simply never considered how to make a space shuttle, having no view on the matter.

So, if we want to explain NASA, PARTY, and LITTER, we need to turn to non-Summativist accounts. We can divide up non-Summativist accounts by considering which part of the knowledge locate at the level of the collective. This gives us the following menu of views to consider:

- i. Group knowledge involves collective belief (Wray 2007);
- ii. Group knowledge involves collective justification (De Ridder 2014; Lackey 2016);
- iii. Group knowledge involves group-level reliability (List 2005);
- iv. Group knowledge involves group-level realisation of functional properties (Bird 2010).

None of these accounts has a satisfying explanation of these cases.

¹⁵ The question of whether SUM_{KNOW} holds is often associated with whether group knowledge is reducible to individual knowledge. The reducibility of group knowledge is orthogonal to the truth of SUM_{KNOW} . One might endorse SUM_{KNOW} and deny the reduction of group to individual knowledge. For example, one might hold a mixed view that claims that both individual knowledge and some group-level phenomenon is necessary for collective knowledge (Lackey 2016). One might also deny SUM_{KNOW} whilst endorsing the reduction. For example, one might claim that group knowledge reduces to some individual-level attitude other than knowledge that p . These points generalise to other group attitudes, meaning we should sharply distinguish between the truth of Summativist claims and the reducibility of group attitudes.

Wray (Wray 2007) appeals to Margaret Gilbert's account of group belief (Gilbert 1987), suggesting that the collective element of group knowledge is a joint commitment to the proposition known (although he argues that we should think of joint commitments as acceptances, not beliefs (Wray 2001)). This account can't handle NASA, PARTY, and LITTER, because the members of the groups in need not be jointly committed to the propositions known by the group. As individuals, the members of NASA might not have any commitments about the best way to make a space shuttle. Although the rowing club and scouts might jointly commit to propositions after having shared their distributed information, these groups know the propositions in question before they pool their knowledge.

De Ridder (de Ridder 2014) argues that scientific knowledge is a collective property because scientific knowledge requires access to reasons for the reliability of belief-forming processes, and in contemporary science this understanding is often distributed between the specialists in a research team. Although this may be a plausible picture of what occurs in some cases of collective scientific knowledge, this diagnosis doesn't fit well with NASA, PARTY, and LITTER. These are cases in which the object of knowledge—rather than the reasons justifying it—is distributed between the members of the group.¹⁶

Lackey's (Lackey 2016) group epistemic agent account of justified belief claims that a group justifiably believes some proposition when it is believed by a significant number of operative members of the group, the bases of individual beliefs in that proposition are coherent, and a rational process of deliberation would lead to a belief set which still supported that proposition. Although this is an account of justified belief, rather than knowledge, it is worth considering whether it can be put to work here. The problem lies in the first condition: in NASA, PARTY, and LITTER no member of the group has a justified belief about the proposition known by the group, meaning that Lackey's account predicts that none of these cases involve collective justified belief.

List (List 2005) develops a judgement aggregation approach to group knowledge. The core idea of this approach is that a group's institutional structure will determine an aggregation function that takes as inputs a profile of individual beliefs, and outputs a collective position for that group (see List and Pettit 2011). We can assess whether a group's collective

¹⁶ Note that the supporter of the Fragmented Knowledge account can treat de Ridder's cases as involving fragmented knowledge of the answer to the question *why is this process reliable?*.

position constitutes knowledge by considering how reliable the outputs of the aggregation function is, which will be a function of both individual reliability and the reliability of the aggregation function. Interestingly, List considers an aggregation function tailor-made for situations involving a division of labour: the distributed premise-based procedure (List 2005: 29). This function splits a group into sub-groups whose attitudes determine the group's attitude on premises which are then combined to yield a collective position on the conclusion (See also List and Pettit 2011: C4). The problem with applying the judgement aggregation approach to understand distributed knowledge is that a group can possess distributed knowledge, even if its institutional structure fails to implement the right aggregation function to exploit this knowledge.

Goldman (Goldman 2004) cites an exchange from the 9/11 commission hearings which illustrates the way a group's aggregation function can diverge from its knowledge. Pressed about why the F.B.I did not internally share information about the 9/11 perpetrators' flight training, former national security advisor Samuel Berger made the following Rumsfeldian pronouncement:

We've learned since 9/11 that not only did we [the FBI] not know what we didn't know, but the F.B.I didn't know what it did know.¹⁷

The force of this remark is that although the F.B.I's aggregation function was faulty – meaning that it was not able reach the right position about whether the perpetrators were a threat – the distributed knowledge possessed by F.B.I members still qualifies the group as having collective knowledge about this question.¹⁸

Bird (2010) pursues an analogical strategy, exploiting the idea that individual and collective knowledge will have the same kinds of functional properties. He argues that the characteristic properties of group knowledge is that it i) is produced by a social process which produces propositional

¹⁷ Full transcript <http://www.washingtonpost.com/wp-dyn/articles/A20349-2004Mar24.html?noredirect=on>

¹⁸ To muddy the waters, we can read 'the FBI didn't know what it did know' in two ways. The first reading is a denial of higher-order collective knowledge (i.e. the FBI was ignorant about the question of what it knew). The second reading is effectively a contradiction test exploiting the ambiguity of 'knows' (Zwicky and Sadock 1975:4). We can get fix this reading, by using the following focus pattern: 'the FBI didn't [know], what it did know' (i.e. the F.B.I knew, but it didn't really know). We are interested in the first reading, according to which the F.B.I.'s higher-order ignorance prevented it from acting on its knowledge.

outputs, ii) involves truth-filtering mechanisms, and iii) yields outputs which are available to social action and other social information-filtering processes.¹⁹ On this account, group knowledge is a state which lies causally downstream of social information-filtering processes, and which can at least potentially feed into other social processes. Fagan (2012) helpfully distinguishes between three senses of collective knowledge: knowledge that is collectively produced, knowledge involving a collective agent, and knowledge involving a collective content. Bird's account is well-suited to explain cases of collective production of knowledge, but it fails to generalise to all cases of knowledge involving a collective agent.²⁰ In the cases under consideration the groups' knowledge need not be the output of a social information-filtering process. NASA might have assembled a group of autodidacts with the appropriate specialised knowledge, and it would still wind up knowing how to make a space shuttle.

Given the failure of extant accounts to make sense of NASA, PARTY, and LITTER, we will need to look elsewhere for an account of the division of epistemic labour. In the next section, I will gather the tools we need to think about these cases, before applying these tools in section 4.

§3 The Mereology of Questions

Following (Lahiri 2002: 188), I think that the right way to understand the cumulative reading of sentences like 1), 3), 5), and 7) is to think of them as ascribing partial knowledge to members of the group that adds up to a resolving answer to the question.²¹ To develop this idea, we will need some tools from the semantics of interrogatives. In particular, we need to understand: i) what questions are, and how they relate to answers ii) partial knowledge-wh, iii) what it is for one question to be part of another, and iv)

¹⁹ Although I am skeptical of conditions i) and ii) in Bird's account, the availability condition FK3 in FRAGMENTED KNOWLEDGE 2 is pretty close to iii).

²⁰ Bird's central interest is in groups that manifest Durkheimian organic unity (see Bird 2014), suggesting that his account should be understood as an account of group knowledge for groups characterised by organic unity. Thus restricted, the worry for his account is that groups with a relevant organic unity—such as NASA—can come to know without undergoing a social process of learning.

²¹ For a similar idea, see (Hardwig 1985: 349). For the details of Lahiri's semantics for the cumulative reading, see (Lahiri 2002: C4), and for an alternative treatment which appeals to quantification over the parts of questions, see (Beck and Sharvitt 2002: 149-52). Note that following Schwarzschild, Lahiri connects the cumulative reading to sentences involving verbs connecting two grammatically plural terms. This means that his account does not neatly carry over to sentences like 1) and 3) which involve grammatically singular noun phrases denoting a group agent (i.e. 'NASA', and 'the Rowing Club').

the different ways in which the answers to several smaller questions can combine to resolve a bigger question. The subsections that follow address these questions in turn.

§3.1. Questions

As I will use the term, a **question** is an entity which is denoted by a sentence or clause in the interrogative mood. The interrogative sentence ‘who came to the party?’ denotes the question *who came to the party?*, just as the declarative sentence ‘Tariq came to the party’ denotes the proposition *Tariq came to the party* (throughout I will use italics for questions, propositions, and predicates, and quotes for sentences and clauses). In the central case, an interrogative sentence or phrase is composed of a wh-word (‘who’, ‘how’, ‘which’, ‘when’, ‘how’, and so on) and a question-abstract (such as ‘came to the party’). In these cases, the wh-word functions as a variable with a domain restriction (for example ‘who’ restricts to people), and the question-abstract expresses a predicate.²²

Questions and propositions are closely related, in that propositions answer questions. In the simplest case they do so by assigning elements in the domain to the extension of the predicate. For example, *Tariq came to the party* answers the question *who came to the party?* by assigning Tariq to the extension of *came to the party*.

One way to make sense of the relation between questions and propositions is to think that a question just is the set of propositions which are its potential answers (Hamblin 1958). There are various ways to build a question out of its answers (for an overview, see Roelofsen 2018). I will employ a possible worlds framework that understands a question as a partitions over a set of possible worlds (this account is based on the presentation in (Roberts 2012)). Although this is not the only possible approach, it allows us to draw the distinctions we need in a perspicuous way without introducing too much background theory.²³

This partition approach takes Hamblin’s idea that a question is a set of propositions (Hamblin 1958), and identifies these propositions with the

²² We will need to complicate the picture to deal with interrogatives with multiple wh-words, ‘whether’ interrogatives, and interrogatives with no question-words.

²³ The distinctions we need would be rather difficult to draw in the alternative semantics proposed by (Hamblin 1973) or (Karttunen 1977). I think it would be possible to reconstruct them within an inquisitive semantics framework (Ciardelli, Groenendijk, and Roelofsen 2018), but this would considerably complicate the presentation.

exhaustive answers favoured by (Groenendijk and Stokhof 1982), meaning that a question is the set of its potential exhaustive answers (Higginbotham 1996; Roberts 2004, 2012). To get to an exhaustive answer, we take the domain suitably restricted by the *wh* word, and the question abstract, then build a possible assignment of all entities in the domain to either the extension or the anti-extension of the predicate expressed by the question-abstract. A question is the set of all of these exhaustive answers. Because each exhaustive answer is a maximal assignment of the entities to the predicate expressed by the question-abstract, each one is incompatible with all of the others.

If we think about answer sets in a possible worlds framework, each exhaustive answer will be a set of worlds corresponding to a maximal assignment of the entities to the predicate expressed by the question-abstract, and the question will be identical to the set of all of these sets of worlds. Because these exhaustive answers are incompatible, this set of sets will be a partition defined over the portion of logical space in which the presuppositions of the question are met.²⁴ Exactly one of these exhaustive answers will be a true proposition (assuming that the question has true presuppositions): the one corresponding to the cell containing the actual world.

This picture allows us to distinguish various different kinds of answer to a question. Borrowing terminology from (Szabo 2017), let's call a proposition that assigns an entity to the extension of the predicate expressed by the question-abstract a **positive minimal answer** (such as *Tariq came to the party*), and a proposition that assigns an entity to the anti-extension a **negative minimal answer** (for example *Paula didn't come to the party*). A conjunction of positive minimal answers is a **mention-some answer** (for example, *Tariq and Paula came to the party*), and any combination of minimal answers with logical connectives is a **partial answer** (for example, *if Tariq came, then Layla didn't come*). The conjunction of positive minimal answers is a **mention-all answer** (for example, *Tariq, Paula and Jerry came to the party*, if these are all of the party-goers). The best kind of answer is a complete set of positive and negative minimal answers to a question, which we will call a **complete answer** (for example, *Tariq, Paula, and Jerry came to the party, and no-one else did*). This kind of answer is often called an exhaustive or strongly exhaustive answer, since it involves both

²⁴ (Lahiri 2002: 10; Mastro 2010).

the complete list of positive answers, and the information that that list is complete.²⁵

The partition framework allows us to think about these distinctions in terms of how many cells in the partition are ruled out by the different kinds of answers. Every potential complete answer will correspond to exactly one cell in the partition, meaning that knowing a complete answer allows one to rule out all but one of the cells in the partition. A mention-some answer won't necessarily isolate just one cell, but will isolate a set of cells at which some conjunction of positive minimal answers holds. Minimal answers allow one to rule out sets of cells in which the minimal positive or negative propositions are false. Partial answers allow one to rule out a set of cells corresponding to the logical connective used: for example, *if A came, then B came* allows one to rule out the set of cells in which A came, but B did not come.

What kind of answer we are interested in will often depend on conversational context.²⁶ If we want to find someone to ask about whether the party was good, a minimal positive answer to *who came?* will do, but if we want to write an oral history of the party, then we'll need a complete answer. Let's introduce the notion of a **resolving answer**, and say that in a conversational context an answer is resolving just in case it gives the interlocutors sufficient information to meet their informational needs with respect to that question.²⁷ In a context in which an interrogative phrase takes a mention-some reading, all that is required for a resolving answer is a mention-some answer, whereas in a case where an interrogative phrase takes a mention-all reading, only a complete answer to the question will count as resolving. The notion of a resolving answer is effectively a placeholder for a pragmatic theory of how a particular reading of the question is selected.

§3.2. Partial Knowledge

²⁵ A complete answer will also be a mention-some answer, a mention-some answer will also be a partial answer, and a mention-some answer will either be or entail a positive minimal answer. Often I will be implicitly adding a 'mere' before 'partial answer'.

²⁶ On the context-sensitivity of the answerhood relation, see (Boër and Lycan 1986).

²⁷ It is somewhat of an idealisation to think that context always fixes which kind of answer is required. Does context always fix whether a mention-some or mention-all reading of an interrogative is intended, or fix a relevant domain of quantification? This means that some knowledge-wh ascriptions (including to groups) will have an indeterminate meaning.

The distinction between partial and resolving answers gives us a helpful tool for understanding the gradability of knowledge-wh ascriptions. A typical knowledge-wh ascription involves a verb with an unmodified interrogative complement. For example:

11) Maja knows which students are in detention.

This kind of sentence ascribes knowledge of a resolving answer to the question expressed by the complement, in this case a proposition specifying exactly which students are in detention. We also find knowledge-wh ascriptions involving adverbs of quantification modifying the interrogative. Consider the following example (with the adverbial phrase underlined):²⁸

12) Maja knows in part which students are in detention.

If Paul, Jojo, and Trent are in detention, and Maja knows only that Paul and Jojo are in detention, then 12) is true. 12) says that Maja knows a partial answer to *which students are in detention?*, and not that Maja has a state short of knowledge relating to a resolving answer to the question. The adverb modifies the interrogative, not the knowledge relation.²⁹ Let's call

²⁸ Some examples with different verbs, adverbs, and question-words:

- 1) Dale has worked out in part how to make the wardrobe
- 2) Patricia learnt for the most part who was at the party.
- 3) John knows to some extent where the lost pages are.

This kind of gradability has been discussed in linguistics under the heading of Quantificational Variability Effects. See (Berman 1991; Groenendijk and Stokhof 1993; Williams 2000; Lahiri 2002: Chapters 2 and 5; Beck and Sharvitt 2002). For a philosophically illuminating application of some of these ideas to the debates about the gradability of 'knows-how' ascriptions and the unity of knowledge, see (Pavese 2017), and (Pavese MS) respectively. Knowledge-wh ascriptions can also be modified by qualitative predicates, such as:

4) Raimo knows how to swim really well.

These predicates seem to modify the entities expressed by the wh-word. What is good is the way of swimming that Raimo knows how to perform (Pavese 2017).

²⁹ Because this kind of gradability involves modification of the interrogative complement rather than the verb, it is compatible with the claim that 'knows' is not a gradable verb (Stanley 2005; Pavese 2017).

knowledge-wh picked out by ascriptions involving quantificational adverbs **partial knowledge-wh**.³⁰

We can use the machinery of answers and partial answers to give accounts of both knowledge-wh and partial knowledge-wh. Here is a fairly standard propositional picture of knowledge-wh (along the lines of [Higginbotham 1996](#)):

KNOWS-WH) *S* knows *Wh-F*? iff *S* knows that *p*, and *p* is a resolving answer to the question *Wh-F*?

The kind of answer appealed to here is a resolving answer, and not a complete answer. In the right context, knowing a mention-some answer (or even something weaker) can be sufficient for a true knowledge-wh ascription. This means that KNOWS-WH commits us to a contextualist semantics for knowledge-wh ascriptions. This view is different to the familiar contextualist accounts of knowledge-that in the sense that it is contextualist about the object of knowledge, rather than about the knowledge relation.³¹ It is what is known, rather than what knowledge is, that is determined by context.

This account can be straightforwardly extended to deal with partial knowledge-wh by replacing resolving answers with partial answers:

PARTIAL KNOWS-WH: *S* knows in part *Wh-F*? iff *S* knows that *p*, and *p* is a mere partial answer to the question *Wh-F*?³²

³⁰ There is considerable discussion about how to understand QVE. Accounts have been proposed that appeal to quantification is over i) the objects which the wh-word ranges over ([Berman 1991](#)), ii) propositional answers to the question ([Lahiri 2002](#)), iii) subquestions of the superquestion ([Beck and Sharvitt 2002](#)), and iv) question-proposition pairs ([Pavese 2017](#)).

³¹ For defences of contextualism about knowledge-wh, see ([Boër and Lycan 1986](#); [DeRose 2009, C2 appendix](#); [Masto 2010](#); [Parent 2014](#)). For a criticism appealing to warranted assertibility see ([Braun 2006](#)) (see also [Hawley 2003](#)). Strength of answer is just one of several kinds of context-dependence involved in knowledge-wh ascriptions. The semantic content of interrogatives will probably also be affected by the domain of quantification ([Stanley 2011: 56-8, 118](#)), modulation of the predicate expressed by the question abstract, and the salient method of identification ([Aloni 2008](#)). Infinitival interrogatives will also involve context-sensitive modals ([Bhatt 2006](#); [Stanley 2011: 126](#)), contextual resolution of the reference of PRO ([Stanley 2011: C3](#)), and may involve unpronounced variables ([Hawley 2003: 21-2](#)).

³² This account is slightly oversimplified for presentational purposes: strictly speaking it should allow answers to causal subquestions which are not partial answers. See section 2.3..

This is a schematic account, and it would have to be complicated to deal with the full range of quantificational modification (see the examples in footnote 28) involving different amounts of knowledge about an answer.

§3.3. Subquestions

Another payoff of the partition approach is that it gives us a clear account of what it is for one question to be part of another (see Roberts 2008, 2012).

We can make a first pass at understanding question-parthood by saying that one question is part of another when it divides up the same portion of logical space, but with a smaller number of more coarse-grained cells. Consider the question *who came to the party?* Assuming a domain of just A and B, this question gives us the following partition of four cells (where 'A' stands for *A came to the party*, and 'a' stands for *A didn't come to the party*):

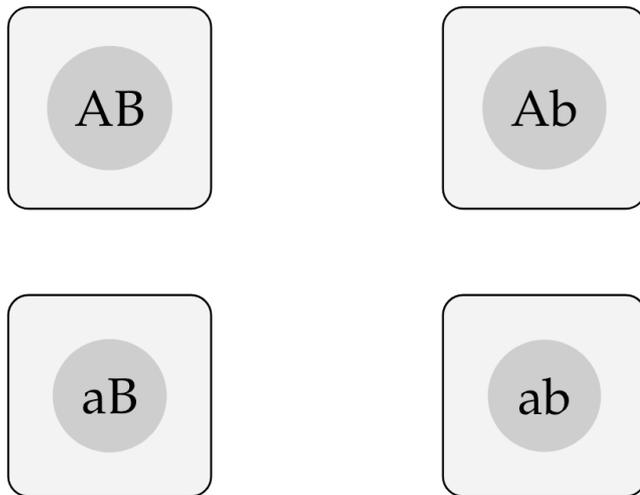


Figure 1. *Who came to the party?*

Although this partition contains relatively few cells, it is easy to see that there are various more coarse-grained ways to partition up the space. For example, we could ask *did A come?* giving us the set {*A came*; *A didn't come*}. Or we could ask *did anyone come?* dividing up logical space into {*someone came*; *no-one came*}.

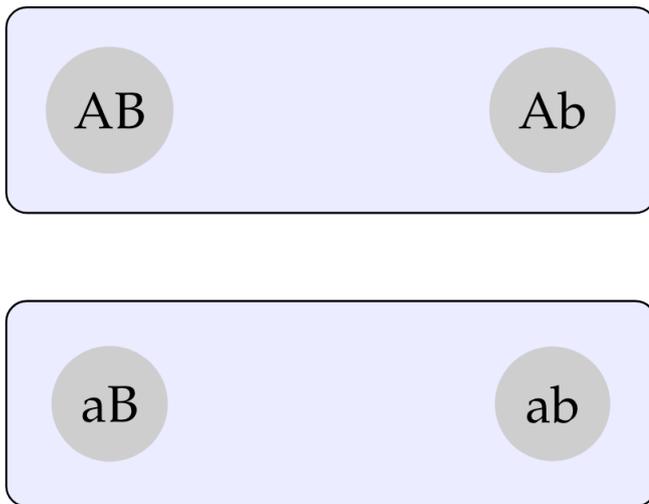


Figure 2. *Did A come to the party?*

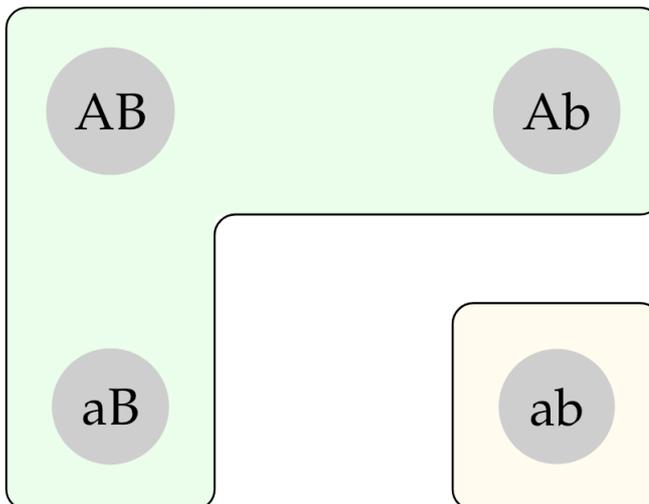


Figure 3. *Did anyone come to the party?*

We can say that both these new questions are **subquestions** of the old question *who came to the party?* in the sense that they are part of the old question. Let's introduce the **strict subquestion** relation to pick out the parthood relation that involves only coarsening the partition. We can give a precise definition of this relation in terms of entailment relations between the answers to the question and its subquestions:

STRICT: Q1 is a strict subquestion of Q2 when a complete answer to Q1 entails a partial answer to Q2.³³

³³ The strict subquestion relation is equivalent to Groenendijk and Stokhof's notion of question-entailment, where Q1 entails Q2 iff every proposition that completely

The notion of parthood picked out by STRICT is useful, but does not cover all the interesting cases. The question *if there was beer at the party, did A come?* is not a strict subquestion of *who came to the party?*. Neither *there was beer at the party*, nor *there was not beer at the party* allow us to rule out any of the cells in the initial question. However, if we want to use the notion of a subquestion to pick out the kinds of questions we can use to build a resolving answer, this kind of question certainly seems to be of interest. One way to include questions like *if there was beer at the party, did A come?* within the subquestion relation is to relax the notion of entailment in to allow entailment of answers against a background of accessible information. We can call this kind of subquestion a **casual subquestion**:

CASUAL: Q1 is a casual subquestion of Q2 iff a complete answer to Q1, together with accessible information, entails a partial answer to Q2.

If there was beer at the party, did A come? is a casual subquestion of *who came to the party?* because an answer to the former question, together with the accessible information that there was beer at the party provides a partial answer to the question of who came to the party.

This move closely parallels Robert's appeal to contextual entailments (Roberts 2004: 210; 2012: 6.11-2, 6.19-20). However, whereas she appeals to information that is already in the context, I am appealing to accessible information: information which agents either have, or could obtain given their epistemic situation and capacities. Exactly what counts as accessible is a complex matter, and the fact that information is accessible does not mean that it is easy to get hold of.

Unlike strict subquestions, casual subquestions can be more complex than the original question. In the right context, *what food was served at the party?* might be a subquestion of *who came to the party?*, but if the culinary possibilities in a context are richer than the potential guests, the subquestion will have more complete answers than the original question. Although questions with only two answers—such as whether question and polar questions—have no strict subquestions they can have casual questions. *Was there beer at the party?* and *what food was served at the party?* might both be a casual subquestions of *whether A came to the party?*.

answers Q1 completely answers Q2 (Groenendijk & Stokhof 1984). A question Q2 is a strict subquestion of Q1 just in case Q1 entails Q2. (Roberts 2012: 6:7).

When I talk about subquestions below, I will have in mind both the strict and the casual notion of a subquestion, and we will need both notions to explain the division of epistemic labour.

§3.4. Building a Resolving Answer from Partial Answers

Finally, and most importantly for my purposes, the partition-based understanding of questions gives us a neat way of thinking about how various non-resolving answers can add up to a resolving answer. I will focus on four ways to combine non-resolving answers:

- i. Combining mention-some answers to reach a mention-all answer;
- ii. Combining partial answers to reach a mention-all answer;
- iii. Combining partial answers to reach a mention-some answer;
- iv. Combining answers to relevant sub-questions to reach a resolving answer.

The simplest way to build a resolving answer is by combining mention-some answers to provide a mention-all answer, adding up the elements on the list to reach the full list. Consider *who came to the party?*, on its mention-all reading. Mention-some answers to this question, such as *A came*, and *B came* can be conjoined to provide a mention-all answer, ruling out all of the cells except *that A&B came*.³⁴ We can add up more complex partial answers to reach the same result. For example, the partial answer *if A came, then B came* allows us to rule out cells in which A came, but B didn't come (the top right cell in figure 1), and if we combine this with *A came*, then we end up with *A&B came*.

When an interrogative has a mention-some reading, all that will be required for a resolving answer is a minimal positive answer. A mention-some answer can also be constructed out of partial answers. For example, if we know the proposition *if A came, then B came*, (ruling out the top right cell), and learn *there was someone at the party*, (ruling out the bottom right cell), then we end up with the cells in which B came (the left column), giving us the required minimal positive answer. We can also employ a strategy of eliminating, reaching a mention-all answer by conjoining negative minimal answers, if we know what the contextually salient domain is. Although answering a mention-some answer involves ruling out some possible complete answers, it need not involve ruling out any true

³⁴ If the question takes an exhaustive reading, then we will also require the conjunction of negative minimal answers.

minimal answers. When I give a mention-some answer to the question *how to skin a cat?* I rule out possible complete answers that include sets of ways that do not include that particular way to skin a cat, but I need not rule out of consideration other possible ways of skinning a cat.

Finally, we can build a resolving answer to a question from answers to its casual subquestions. For example, we can combine answers to the questions *if there was beer at the party, did A come?* and *was there beer at the party?* to determine whether A came to the party. This combination of answers to sub-questions will be especially important in the case of polar questions – like *whether p?* – which have no strict subquestions.

This section has taken us rather far away from the core concerns of social epistemology, so let's summarise the key claims of the framework:

- i) A **question** is a set of potential exhaustive answers, or a partition of a portion of logical space;
- ii) A **complete answer** to a question is a proposition which rules out all of the cells in the partition except one;
- iii) A **partial answer** to a question is a proposition that rules out some of the cells in the partition;
- iv) A **resolving answer** to a question is a proposition which in a conversational context rules out enough cells in the partition to satisfy the epistemic needs of conversational participants;
- v) An agent has **knowledge-wh-F**, when they know a proposition that is a resolving answer to the embedded question *Wh-F?*;
- vii) An agent has **partial knowledge-wh-F**, when they know a non-resolving partial answer to the embedded question *Wh-F?*;
- viii) The **subquestions** of a question are those where a complete answer to those questions entails a non-resolving answer to the initial question, either by themselves (**strict subquestions**), or with the addition of accessible information (**casual subquestions**);
- vii) Non-resolving partial answers and answers to strict and casual subquestions can add up to a resolving answer to a question.

§4 Subquestions and the Division of Epistemic Labour

With these tools from the semantics of interrogatives in hand, we can explain how the groups in NASA, PARTY, and LITTER can have collective knowledge in virtue of the knowledge distributed between their members.

Let's start with PARTY, since mention-all readings involve the most straightforward way of partial answers adding up to a resolving answer. We are aiming to explain the truth of the following sentence:

3) The Rowing Club knows who came to the party.

In this case the interrogative *who came to the Party?* takes a mention-all reading, meaning that a resolving answer is a complete list of exactly who came to the party. None of the members of the Rowing Club are in possession of such an answer. Each member of the club only knows a partial list corresponding to a partial answer, meaning that they each have partial knowledge-wh. Crucially, putting these partial lists together yields a complete list of who came. To put this point in terms of partial answers: putting their mention-some answers together would yield a resolving complete answer which ruled out all of the possible combinations of people that might have come, except the combination which in fact obtained.

A slight wrinkle emerges when we notice that *who came to the party?* might take the strongly exhaustive reading associated with complete answers, requiring not just the complete set of people that came, but also the information that no-one else came. Until they put their heads together, none of the members of the Rowing Club knows that any list of party-goers is the complete answer (although they might know that the combined list would be a resolving answer). We might worry that if the interrogative takes an exhaustive reading, the members of the Rowing Club do not have a resolving answer between them. There are two options here. We might take 3) to express a non-exhaustive mention-all reading, meaning that a resolving answer requires only the complete set of positive minimal answers. Alternatively, we could say that the Rowing Club really does collectively know the answer to the question with a strongly exhaustive reading, because although the exhaustivity information is not known by any individual, it would become available after pooling. I think that the first line is more plausible, allowing us to say both that the group knows who came to the party (on the mention-all reading), and that it stands to gain something by collating its members' knowledge.

In NASA, we are interested in the following sentence:

1) NASA knows how to make a space shuttle

In this case we want to combine individual pieces of knowledge to yield a mention-some answer to the question *how to make a space shuttle?*. A complete answer to a how-to question will be an exhaustive set of complete

methods (i.e. a complete negative and positive assignment of *is a way to make a space shuttle* to all ways in the domain). This kind of answer is extremely demanding, and for most purposes a resolving answer will be one that provides one complete method for the task at hand. With *how to V?* questions, the relevant kind of partial answers will usually be ones that specify a method for a sub-task of the activity of V-ing: in this case methods for the various sub-tasks involved in making a space shuttle. A sub-task specifying partial answer provides us with a method for performing that sub-task. This allows us to rule out all the possible complete answers to the question which do not contain a complete method involving the relevant method for performing the sub-task. A set of sub-task partial answers can combine to yield a resolving to the question, when the methods for performing the various subtasks combine to provide a complete method for performing the overall task. This is exactly the structure which we find in the NASA case. Each of the specialists knows how to perform one sub-task, meaning that they each possess a partial answer to *how to make a space shuttle?*³⁵ Putting these partial answers together yields a complete method for building a space shuttle, meaning that the individual-level partial knowledge combines to give group-level knowledge-how.

Finally, let's consider LITTER. We need to explain the truth of two sentences:

- 5) The scouts know whether the whole path is litter-free.
- 7) The scouts know that the path is litter-free.

Start with 5). Whether-questions are simple $\{p; \text{not-}p\}$ partitions, meaning that there are no partial answers to this kind of question. We cannot add partial modifiers to knowledge-whether, meaning that the following sentence is anomalous:

- 13) #Arabella knows in part whether Jane came to the party.

³⁵ One might worry that a group could have members who know how to perform relevant subtasks, but do not know how to co-ordinate them. The structure of how-to questions rules out this possibility. Both in the individual case and the collective case, merely knowing how to perform subtasks without knowing how to string them together appropriately is insufficient for knowing a resolving answer to the question *how to V?*. When a task is order-sensitive, merely knowing that the task V-ing involves A-ing, B-ing, and C-ing does not suffice for isolating a resolving answer, say the proposition *A-ing, then B-ing, then C-ing is a way to V*. One of the subquestions to a how-to question will be the question *how should we put the other sub-tasks together?*.

To make sense of sentence 5) we will need to build up a resolving answer to the question from the answers to its casual subquestions. In LITTER, each of the individual scouts searched a portion of the road for litter, meaning that by the end of each of their searches they knew whether there was any litter on their assigned part of the road. The question *whether stretch A is litter-free?* is a causal subquestion of *whether the whole path is litter-free?* because an answer to the former question, when combined with a body of accessible information — in particular, information about whether all of the other stretches of the road are litter free — will entail an answer to the latter question. So, in this case, all of the scouts know answers to causal subquestions of *whether the whole path is litter-free?*, which are such that then the answers to these questions are combined together, they entail a complete answer to the question of whether the path is litter free.

This leaves us with the collective knowledge-that ascription in 7). A knowledge-that ascription does not semantically express *any* question, but we can take a parallel approach to this kind of case by considering this proposition against the background of a question supplied by context. A fairly natural move here is to appeal to the question under discussion in the attributor’s conversational context (Roberts 2012), and take the that-clause to express an answer relative to that question (Schaffer 2007; 2008). For example, when we utter sentence 7) thinking about the scenario described in LITTER we are presumably interested in the question *whether the path was litter-free?* meaning that we are thinking of the proposition *that the path was litter-free* as an answer to that question.³⁶ With this contextually supplied question in place, we can repeat the story about how the answer *the path is litter-free* was constructed from answers to causal subquestions like *whether stretch A is litter-free?*³⁷

§5 Fragmented Knowledge

³⁶ The appeal to questions under discussion is another place where the contextualist bent of the Fragmented Knowledge account shows up. For non-contextualist theories, background questions are a potential source of error. These errors might either be due to pragmatic (Brown 2006; Rysiew 2007; Pritchard 2010), or psychological effects (Nagel 2010; Gerken 2017; Dinges 2018).

³⁷ The information possessed by group members need not add up to a resolving answer to the question under discussion. If the question under discussion was *what interesting objects are on the path?* and the scouts have only looked for litter, they could still know *there is not litter on the path?* relative to *what interesting objects are on the path?*.

As we formulated it in the introduction, the Fragmented Knowledge account involves two kinds of conditions: individual-level conditions concerning the knowledge of group members, and group-level conditions concerning what propositions the group is disposed to act on. Let's start off by considering an account which takes the first kind of condition to be sufficient for collective knowledge in order to motivate the need for the second condition (5.1). I will then formulate the second condition and present the full account (5.2), before considering some upshots of the account. We will consider the Fragmented Knowledge view's commitment to contextualism about collective knowledge ascriptions (5.3), an analogy with the JTB theory of knowledge (5.4), how the account might be adjusted to account for non-propositional accounts of knowledge-wh (5.5), how the account fits into the debate between Summativists and non-Summativists (5.6), and how it handles knowledge-action connections, and group defeat (5.7).

§5.1. Fragmented Knowledge 1

If we follow the core intuition that individual-level partial knowledge can add up to group level resolving knowledge, we get the following account of group knowledge:

Fragmented Knowledge 1

A group G knows p relative to the question $Wh-F$ if:

FK1. Some of the members of G know a set of propositions $\{p_1, p_2, \dots, p_n\}$, where all of those propositions are either a partial answer to the question $Wh-F?$, or an answer to a subquestion of $Wh-F?$

FK2. Combining the propositions $\{p_1, p_2 \dots p_n\}$ relative to the question $Wh-F?$ yields p as an answer to the question $Wh-F?$.³⁸

³⁸ This account (and those below) might also be extended to deal with knowledge of subject matters. Knowledge of subject-matters can involve the division of labour: If each member of the history department knows one of the periods of history for 3,000 BCE to 500 CE, then collectively, the history department knows the period 3,000 BCE to 500 CE. These cases can also be modelled in a partition-based framework. Following Lewis (Lewis 1988a; Lewis 1988b), and Yablo (Yablo 2014; Yablo 2016) we might take subject matters to be partitions (with each cell being a way the relevant portion of the world might be), and take knowledge of a subject-matter to relate an agent to a partition (Yablo MS) which allows us to model collective knowledge of a subject matter in terms of individuals ruling out

This account will be able to explain cases of division of labour in the way set out in the last section.³⁹ However, the account runs into two problems: it is insufficiently restrictive, and it fails to predict important connections between collective knowledge and action.

FRAGMENTED KNOWLEDGE 1 predicts that individual knowledge is sufficient for group knowledge. If p is a partial answer to the question *Wh-F?*, and a member of the group knows it, the group will contain members whose knowledge rules out all *not-p* possibilities, meaning that the group also knows that p . If Allie is a member of NASA, and she knows where she left her keys (in the fridge), according to this account, NASA also knows that Allie left her keys in the fridge.⁴⁰ This account grossly inflates the amount of knowledge had by group agents, and ascribes knowledge which is unhelpful for predicting or explaining group behaviour.

FRAGMENTED KNOWLEDGE 1 also gets into trouble with the following kind of case:

QUARTET: The members of a string quartet are learning to play Mozart's Quartet no14 by memory for an upcoming concert. The viola player and cellist have learnt their parts, and the first violinist has learnt both her part and the second violin part in order to understand how their parts fit together. However, the second violinist has not learnt their part. The first and second violin parts are too complicated to play both at the same time by double stopping.

The members of the quartet between them know a set of answers to a set of subquestions of *how to play quartet no 14?*, (FK1.1.), and these answers add up to a complete way to play the piece, including information about how the parts fit together, (FK1.2.). This means that according to FRAGMENTED KNOWLEDGE 1, the string Quartet knows how to play Mozart's Quartet no14. However, the group does not collectively know how to play Mozart's Quartet no14.

different cells in that partition. On the relation between subject-matters and questions, see (Szabo 2017).

³⁹ One might worry that this account just reinvents the notion of distributed knowledge familiar from epistemic logic (Meyer and van der Hoek 1995; Fagin et al 2003). For a discussion of the relation between distributed knowledge and question-sensitive pooling, see (Baltag, Boddy and Smets 2018).

⁴⁰ This worry is closely related to the 'irrelevant beliefs' criticism of Summativism about group belief (Gilbert 1989; Schmitt 1994).

QUARTET nicely brings out the intuition that collective knowledge requires the possibility of collective action. Both in the individual and collective cases, knowledge is the kind of thing that agents are able to act on (a point stressed by (Bird 2010: 41-6)). There are various ways a group can act on its knowledge, including by using the proposition known as an input to practical reasoning, by asserting the proposition known, or by performing the action which one knows how to do. In cases where the relevant actions involve a division of labour, this connection between knowledge and the possibility of acting on knowledge means that the division of epistemic labour required for group knowledge will mirror the division of practical labour required for successful group action (Harris MS). In QUARTET, the members of the group have all the knowledge they need, but it is distributed across the players in the wrong way to yield collective knowledge-how because it does not correspond to the natural division of practical labour involved in playing the piece.

§5.2. Fragmented Knowledge 2

In order to reflect the connection between knowledge and action highlighted by QUARTET, we need to add an extra condition on collective knowledge: that the proposition known be available for collective action. I understand availability in the following way:

AVAILABILITY: A proposition p is available to collective action for some group G iff G is disposed to act on the basis of p in a relevant set of group-appropriate tasks, where this disposition is indexed to situations which are both environmentally normal, and involve the group functioning in accordance with its constitution.⁴¹

This condition relativises availability to two context-sensitive indexes: relevant tasks, and situations. The context-sensitivity of group ability ascriptions ought to be unsurprising given the context-sensitivity of ability ascriptions in general (Kratzer 1977). Let's unpack these two dimensions of context-sensitivity in turn.

In general, when we're thinking about whether a group knows that p , one thing we should consider is whether the group is disposed to assert p , use p as a premise in practical reasoning, and act as if p were true. However, when we are thinking about some kinds of groups, our interest can be focused on a more specific set of tasks. For example, what Schmitt calls

⁴¹ The task-sensitivity in this condition takes inspiration from (Hawley 2003).

chartered groups are set up to perform specific kinds of actions (Schmitt 1994: 172-3), and when we are considering these groups, the relevant tasks will plausibly be those specified by the group's constitution. The shuttle-building department in NASA might be set up so that it can only make space shuttles. If this is so, the shuttle-building department will not know where Allie's keys are, because (in normal situations) this proposition is not suitable for employment in the task of building a shuttle.

The set of actions under consideration can also be restricted by contextual salience. In my description of QUARTET I snuck in a salient task—playing the piece live from memory—in order to elicit the intuition that the Quartet did not know how to play the piece. If I had made a different task salient, our intuitions would have differed. If recording the piece was a salient we might have judged that the group did know how to play the piece, because the group could have exercised their distributed knowledge to record the piece successfully by having the first violinist lay down both the first and second violin parts.⁴²

In addition to the tasks variable, AVAILABILITY is also sensitive to salient situations. When evaluating the availability of some proposition, I suggest that we look to situations which are both environmentally normal, and involve the group working in accordance with its constitution. We need to look to normal environments to avoid group knowledge being undermined by a hostile environment. NASA still knows how to make a space shuttle during a government shutdown, it's just that they can't act on that knowledge. We need to look at situations in which the group is working in accordance with its constitution to reflect how a group's constitution affects its knowledge. For example, a jury might be forbidden by its constitution from employing hearsay evidence in its deliberations, meaning that although all the members of a group might know that the accused is guilty, the group collectively does not know that fact because it is not appropriately actionable.⁴³ A group's constitution can restrict the kind of evidence it employs (as in the jury case), and it can also restrict the types of proposition a group can know, or require specific procedures for knowledge (see Lackey 2016: 272-3).⁴⁴

⁴² See (Birch 2018) for a narrower conception of group knowledge-how that excludes such cases of prepackaged co-operation.

⁴³ This case is adapted from (Schmitt 1994).

⁴⁴ A special case is the requirement for consensus. If a group's constitution requires that its members agree on a question before it can act, then the possibility of consensus is a requirement for collective knowledge. If the group's constitution makes no such requirement, then it is possible for the group to know although they are not in a position to reach consensus.

Adding the availability of a proposition to FRAGMENTED KNOWLEDGE 1 won't quite fix things, since a proposition might be available to collective action for some reason which has nothing to do with individual knowledge. We need to add both AVAILABILITY, and the requirement that a proposition is available to collective action because it is known by members of the group. This gives us the following account:

FRAGMENTED KNOWLEDGE 2

A group G knows that p relative to the question $Wh-F?$ only if:

FK1. Some of the members of G know a set of propositions $\{p_1, p_2, .. p_n\}$, where all of those propositions are either a partial answer to the question $Wh-F?$, or an answer to a subquestion of $Wh-F?$

FK2. Combining the propositions $\{p_1, p_2, .. p_n\}$ relative to $Wh-F?$ yields p as an answer to $Wh-F?$.

FK3. The proposition p is available to G for collective action;

FK4. Condition iii. obtains because of conditions FK1 and FK2.

In the remainder of this section, I will unpack some features of the account, and deal with some worries.

§ 5.3. Contextualism

At a number of points above I have noted ways in which knowledge-wh ascriptions are context-sensitive. These mechanisms of context-sensitivity are a little complex, so it is worth unpacking how they affect the Fragmented Knowledge account. Strictly speaking, FRAGMENTED KNOWLEDGE 2 is an account of the knowledge-wh relation. To formulate an account of collective knowledge ascriptions, we can employ semantic ascent. Starting with collective knowledge-wh ascriptions, we get:

SEMANTICS FOR FRAGMENTED KNOWLEDGE 2

A sentence of the form 'G knows $Wh-F$ ' is true in a context C iff

SFK1. Some of the members of G know a set of propositions $\{p_1, p_2, .. p_n\}$, where all of those propositions are either a partial answer to the

question *Wh-F?* – which is the question expressed by ‘*Wh-F?*’ in *C* – or an answer to a subquestion of *Wh-F?*;

SFK2. Combining the propositions $\{p_1, p_2 \dots p_n\}$ relative to *Wh-F?* yields *p* as an answer to *Wh-F?*, and given the discussants’ epistemic needs and purposes in *C*, *p* counts as a resolving answer to *Wh-F?*;

SFK3. Given the situations and tasks that are salient in *C*, the proposition *p* counts as available to *G* for collective action;

SFK4. Condition SK3. obtains because of conditions SFK1 and SFK2.

For a collective knowledge-that ascription, we replace SFK1 with SFK1*, and include SFK2, SFK3, and SFK4 as above:

SFK1*. Some of the members of *G* know a set of propositions $\{p_1, p_2, \dots p_n\}$, where all of those propositions are either a partial answer to the question *Wh-F?* – which is the salient question in *C* – or an answer to a subquestion of *Wh-F?*

This semantics relies on a number of bits of contextualist machinery. First, the semantics for knowledge-that ascriptions in SFK1*) appeals to a salient question to provide a background for the ascription. Secondly, the meaning of the interrogative will be sensitive to a number of features of context, even if expressed by an interrogative (see footnote 31). Thirdly, the availability relation in condition SFK3 of the account is sensitive to salient tasks and situation, which will be a function of context, and often the kind of group in question. These commitments mean that the account will be vulnerable to criticisms of contextualism, but I hope to have made the case along the way that contextualism is necessary to make sense of the shiftiness of both knowledge-wh and collective ability ascriptions.

§ 5.4. Analogy to Justified True Belief theory of Knowledge

The conditions in FRAGMENTED KNOWLEDGE 2 play rather similar roles to justification and belief in the Justified True Belief account of individual knowledge, which suggests that the individual conditions might be used to develop accounts of collective justification, and collective belief.

We can think of the individual knowledge that goes into the base of collective knowledge in conditions FK1 and FK2 in FRAGMENTED KNOWLEDGE 2 as providing something like the group’s epistemic potential (see [Baltag, Boddy, and Smets 2018](#)), or its propositional

justification. We can think of SFK3 as functioning something like a belief condition, given the close connections between believing some proposition and acting as if it were true. FK4 functions much like a basing relation in the individual case.

This analogy suggests that we might extract the conditions in FRAGMENTED KNOWLEDGE 2 to give accounts of group belief, group justification, and also of collective ignorance. There isn't space to defend these accounts here, so we will just note their existence.

Extant accounts of collective belief either work in a judgement aggregation framework (List and Pettit 2011) or appeal to joint commitment (Gilbert 1987; Gilbert 1989). Following the lead of dispositionalists about belief in the individual case (Ryle 1949; Marcus 1990; Schwitzgebel 2002), we might ask whether we might analyse collective belief in terms of dispositions to collective action. As it stands, AVAILABILITY gives us a decent first pass at a dispositionalist account of group belief:

BELIEF

A group G believes p , only if:

FB1. The proposition p is available to G for collective action.

FK1 and FK2 can be thought of as providing the kind of justification required for collective knowledge. Knowledge requires truth, and a rather stringent level of justification, so to get a general account of justified belief, we need to switch the individual-level ingredients from individual knowledge of true propositions to individual justified belief in any old proposition. This gives us the following account of collective (propositional) justification:

FRAGMENTED JUSTIFICATION

A group G is justified to believe that p relative to the question $Wh-F?$ only if:

FJ1. Some of the members of G have justified beliefs in a set of propositions $\{p_1, p_2, .. p_n\}$, where all of those propositions are either a partial answer to the question $Wh-F?$, or an answer to a subquestion of $Wh-F?$

FJ2. Combining the propositions $\{p_1, p_2 \dots p_n\}$ relative to the question $Wh-F?$ yields p as an answer to the question $Wh-F?$.

Combining FRAGMENTED JUSTIFICATION with BELIEF and the basing claim in FK4., would give us an account of group doxastic justification.

This account of collective justification helps us to understand the epistemic situation of groups that are not capable of collective action. This helps us to respond to a potential worry. It is natural to ascribe knowledge to widely dispersed social groups that do not have the institutional structures required for collective action. For example, we might say that the victims of austerity know the human cost of austerity politics, although this group cannot perform social actions in the same way that a corporation or political party might.⁴⁵ Taking this account of collective justification we can say that this group has collective propositional justification for a host of claims about the human cost of austerity politics, although the group does not collectively know these claims because it is not disposed to act on their basis. This group is in a position to know the human cost of austerity politics, but doesn't strictly speaking have knowledge (Lackey 2014: 294-5).

Assuming that ignorance is the absence of knowledge (Le Morvan and Peels 2016), we can also use FRAGMENTED KNOWLEDGE 2 to give us an account of collective ignorance. The four conditions in the account of collective knowledge suggests that there are four basic ways for a group to be ignorant that p relative to some question $Wh-F?$:

- i. If the members of the group do not know answers to subquestions of $Wh-F$;
- ii. If combining partial answers to $Wh-F?$ known by members of the group does not yield p ;
- iii. If p is not available to collective action;
- iv. If p is available to collective action, but not because of relevant knowledge had by group members.

Although we haven't had space to defend these accounts of collective justification, belief and ignorance, the mere existence of these accounts is evidence that thinking about group epistemology in a question-based framework is productive.

§ 5.5. Summativism and Non-Summativism

⁴⁵ Plausibly, anti-austerity campaigns advocate for, and don't act on behalf of the victims of austerity.

FRAGMENTED KNOWLEDGE 2 is a non-Summative account of group knowledge, because it denies SUM_{KNOW} . This account allows that the object of collective knowledge might be distributed between the members of a group, meaning that no individual knows what the group does. Although it is non-Summativist, this account is still reductivist: collective knowledge reduces to individual-level partial knowledge (FK1, FK2), and dispositions regarding collective action (FK3). According to this account, to tell a story about a group's knowledge, all we need is a story about its members' knowledge and the role of this knowledge in the life of the group.

Unlike Bird's account, which allows that group knowledge can float completely free of individual knowledge (Bird 2010: 33-5) FRAGMENTED KNOWLEDGE 2 claims that collective knowledge relies on individual knowledge. If the members of a group that have relevant partial knowledge were to lose it (or were to leave the group) the group would thereby lose its knowledge.⁴⁶ Interestingly, because of the availability condition, this account also predicts that a group might also lose or gain knowledge by changing whose knowledge it acts on. If a group were to suddenly include its female members on decision-making committees, then its collective knowledge would thereby increase because the group would be disposed to act on more of its members' knowledge.

§ 5.6 Non-propositional Approaches to Knowledge-wh

I have taken on the assumption that knowledge-wh and -how are propositional to simplify the presentation, which also helpfully makes clear the generality of the Fragmented Knowledge account. However, it would be possible to reformulate a version of this account that allows for non-propositional knowledge. The idea at the centre of this account is that group knowledge of some object can involve individuals knowing different parts of that object. We have focused on a way to elaborate this claim using questions and sub-questions, but there are different possible pictures corresponding to different pictures of the part-whole structure of the objects of knowledge.

⁴⁶ The literature on uninvention provides a diverse set of examples of this phenomenon. On the uninvention of nuclear weapons (Mackenzie and Spinardi 1995), and on the uninvention of mathematical proofs see (Steingart 2012). Both of these examples involve the loss of knowledge due to the death of relevant individuals. For an example involving uninvention due to deliberate exclusion, see Marie Hicks's account of the role of women in early electronic computing in the UK (Hicks 2017).

As a proof of concept consider someone who thought that knowledge how to do something was identical with the ability to do it. Someone who was committed to this kind of theory might claim that a group knows how to do some activity when the members of the group are able to perform a suitable set of sub-activities, and the group is able to co-ordinate those activities in collective action (see [Birch 2018](#) on co-ordination enablement). Instead of fragmenting the answers to a question, this theory would fragmented an activity into subactivities. The point to stress is that it isn't just questions that can be fragmented: pretty much any possible object of knowledge-wh and how can be.⁴⁷

That said, it's worth stressing that the assumption that knowledge-wh is a relation to a proposition need not lead to a commitment to a strong form of intellectualism ([Stanley and Williamson 2001](#)). One can think that the object of knowledge-wh and -how is a proposition or question, whilst thinking that this relation is radically different to the one involved in knowledge-that ([Glick 2011](#)). For example, one might think that knowledge-how involves an ability-type relation to a question ([Habgood-Coote 2019](#)), and still employ the machinery of questions and subquestions in the way I have done above.

§ 5.7 Knowledge Norms and Group Defeat

Lackey ([2014](#)) argues that the existence of social knowledge—that is group knowledge that is not accompanied by individual knowledge—is incompatible with the epistemic norms governing action, and the possibility of psychological defeaters for social knowledge. The Fragmented Knowledge account is well-placed to respond to these concerns. Let's take them in turn.

Lackey's first worry appeals to the sufficiency direction of the knowledge norm of action:

KA: If one knows that p , then it is epistemically permissible to act as if p .

Lackey points out that in some cases in which ([Bird 2010](#)) countenances collective knowledge, none of the members of the group

⁴⁷ One caveat: some views about the object of knowledge-how – such as objectualism ([Bengson and Moffett 2011b](#)) – aren't well placed to explain partial knowledge-wh ascriptions ([Pavese 2017](#)), meaning they will struggle to explain the cumulative reading of group knowledge ascriptions.

would be epistemically well-positioned to act as if p (Lackey 2014: 285-91). Since a group can only act through its members, KA together with the absences of appropriate individual action suggests that the groups in these cases do not possess knowledge.⁴⁸

The Fragmented Knowledge account closes the gap between collective knowledge and epistemically permissible action. The availability condition (FK3) bakes a knowledge-action connection into FRAGMENTED KNOWLEDGE 2, so the question is whether the presence of distributed knowledge renders these actions epistemically appropriate. It isn't hard to think of cases in which a group knows, but a member's action is nonetheless inappropriate. If one member of the Rowing Club were to correctly guess who came to the party, and then made a statement on behalf of the group, this assertion would be epistemically improper. However, I submit that what goes wrong in this case is not that the group does not know, but that the member's assertion fails to express the collective's knowledge. We can find parallel cases in the individual case: if you ask me whether I'm free for dinner and I guess and say yes, my assertion is inappropriate, even if I do in fact know that I'm available. In both cases what seems to go wrong is that the assertions do not express the agents' knowledge. Turri (2011) proposes to tweak the norm of assertion to one requiring that an assertion expresses knowledge, and we can make a similar tweak to the sufficiency direction of the knowledge norm of action. This gives us the following norm:

KA*: if one's action expresses knowledge that p , then it is epistemically permissible to act as if p .

Putting KA* together with FRAGMENTED KNOWLEDGE 2, a group's actions are epistemically appropriate when the members acting on behalf of the group are accessing the knowledge distributed amongst the members of the group. It is difficult to find counterexamples to this picture: this would require finding a case in which a group member's action on behalf of the group accesses the distributed knowledge of the group, but that action is not epistemically appropriate.

Lackey's second worry centres around the possibility of group knowledge being defeated (see also Carter 2015). We would expect that like

⁴⁸ Lackey's objection targets both cases of the division of epistemic labour and Bird's publication cases (Bird 2010: 30-6). This response can be used to defend the presence of collective knowledge in both cases, but it's worth stressing that FRAGMENTED KNOWLEDGE 2 does not predict that the scientific community knows in the publication cases (see section 5.5).

individual knowledge, group knowledge can be defeated by various psychological and normative facts. Lackey points out that Bird's (2010) account predicts that a group can know that p whilst every member of that group believes *not-p*. Since most accounts of collective belief predict that the group in this case would collectively believe that *not-p*,⁴⁹ this suggests that Bird's account is incompatible with psychological defeat for group knowledge.

The Fragmented Knowledge account faces a related worry. Because this account only looks to members' knowledge and collective dispositions to determine the presence of collective knowledge, it allows distributed knowledge that radically diverges from individual beliefs. For example, the members of NASA might each know how to do their task whilst having a false belief about the number of tasks involved in making a space shuttle, and the members of the Rowing club might know partial lists of who came while all having false beliefs about how many people came. In both cases, the group might know some proposition composed of partial answers, although all members of the group believe that that proposition is false.⁵⁰

Although FRAGMENTED KNOWLEDGE 2 allows for collective knowledge in the face of individual disbelief, it leaves space for a couple of mechanisms of defeat.

One way collective knowledge can be defeated is via defeat of individual-level partial knowledge. If the Rowing club's putative collective knowledge depends on Ann knowing that A and B came to the party, but all other members of the club falsely believe that A didn't come to the party, then – even if Ann is not aware of her fellows' beliefs – her belief may be subject to normative defeat on the grounds that she should have known what the other members of the group believe. This mechanism doesn't require universal false belief: even a moderate level of disagreement at the individual level might knock out the individual knowledge required for collective knowledge. Note that whether individual knowledge is defeated depends on the false proposition believed: the false belief that only four people came to the party will not defeat knowledge that A came.

⁴⁹ I will set to one side the question of whether the group has collective belief in these cases. If group belief is merely a matter of group-level dispositions (see section 5.4.) FRAGMENTED KNOWLEDGE 2 can save the connection between group knowledge and group belief.

⁵⁰ This may be particularly common with collective knowledge-how: in the individual case there are many cases in which knowledge-how is accompanied by false belief. See, (Wallis 2008: 139-40; Cath 2011; Glick 2011: 409; Michaelson and Brownstein 2016).

Another mechanism for defeat exploits AVAILABILITY. Even if individual-level partial knowledge remains undefeated, individual false beliefs about the answer to a question may modify the group's dispositional states. If all the members of the Rowing Club falsely believe that exactly four people came to the party, they may block the group from publishing a report that claims (correctly) that only three people came. If individuals stop the group from acting on distributed knowledge, then according to FRAGMENTED KNOWLEDGE 2, the group will no longer know who came to the party because it will not have appropriate dispositions.

§6 Conclusion

Philosophical discussions about group knowledge have proceeded on the assumption that if there is an interesting relation between individual and group knowledge, it must be at the level of individual propositions. In this paper I have tried to shake this assumption, considering cases of the division of epistemic labour in which a group knows some body of information when the members of the group know various different parts of that body of information. I have argued that cases of the division of labour can be understood by appealing to the mereological structure of questions, and have proposed the Fragmented Knowledge account to explain the kind of knowledge present in these cases. Although I have stopped short of proposing that FRAGMENTED KNOWLEDGE 2 is the only way to think about collective knowledge, I think that it explains a swathe of central cases, and sheds light on some important features of group knowledge.

To close, I want to note some ways in which the framework developed in this paper can be extended. First, the approach of using questions and subquestions to think about the epistemic state of a group could be extended to develop accounts of collective justification, belief, and ignorance as we saw in section 5.4. Generalising further, we might use a question-focused account to make sense of group inquiry and the collective production of knowledge. Secondly, the Fragmented knowledge account might be used to help us to think about epistemic principles of group design. If group knowledge is a matter of individual knowledge being available to collective action, then maximising collective knowledge involves combining mechanisms that access individual knowledge with those that facilitate collective action. Thirdly, the account might be scaled up to think about larger groups. This might be useful as part of a project of

demystifying political and scientific knowledge by revealing them as involving massively distributed knowledge.

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