EPISTEMIC AUTONOMY & GROUP KNOWLEDGE

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Abstract:

A growing number of philosophers claim there are cases of knowledge in which no individual can possess all the epistemic materials (e.g. evidence possessed, cognitive abilities exercised) generating it. John Hardwig (1985) famously identified two opposing ways of analyzing such cases. (1) *Epistemic Autonomy*: to possess knowledge, a subject must possess all the epistemic materials generating it; so, such knowledge can be possessed only by the *group* subject across which these materials extend. (2) *Epistemic Extension*: a subject can possess knowledge even when other subjects possess some of the epistemic materials generating it; so, such knowledge can be possessed by *individual* subjects. I argue that, of the two options, the latter is preferable: epistemic autonomy is not necessary for possessing knowledge. That is, some knowledge is *extended knowledge*. This is the paper's partisan conclusion. I then employ the issues explored in this paper to generate a novel framework for conceptualizing and organizing social and group epistemology, and for identifying unexplored possibility space in group epistemology. The bulk of group epistemology to-date can be classified as *intra*-group epistemology: concern with the epistemically salient happenings *within* groups. The possibility space I identify is *inter*-group epistemology: concern with the epistemically salient happenings *between* groups. I aim to motivate exploration of this new frontier in epistemology.

Introduction

The explanandum/explanans distinction in epistemology is the distinction between the appraisal and the thing appraised. The explanandum is some normative fact or set of facts (e.g. that justification is secured, that reliability obtains, that epistemic responsibility has

been taken), deemed relevant by one's preferred model of epistemic normativity. The explanans are the *epistemic materials* those facts are about (e.g. evidence possessed, deliberations undertaken, inferences drawn, cognitive abilities exercised). They are those things that do or do not meet the normative threshold of the appraiser's model of epistemic normativity. Of course, internalists and externalists characterize epistemic materials differently. Internalists say epistemic materials are all mental states or exercises, or a subset of these. Externalists contend that non-mental cognitive states or exercises also qualify. But, for the most part, internalists and externalists alike endorse the traditional epistemological tenet that having *epistemic autonomy* is necessary for having knowledge. That is, possessing knowledge entails possessing all the epistemic materials generating it.[1]

A growing number of philosophers, on the basis of diverse models of epistemic normativity, claim there are cases of knowledge in which no individual has the capacity to possess all the epistemic materials generating it.[2] That is, some knowledge cannot be generated autonomously by any individual. Call these cases of *extra-individual knowledge* (EIK).[3] The most vivid cases of EIK are scientific. Consider the CMS and ATLAS particle-detection experiments, which are two of seven experiments centralized at CERN's Large Hadron Collider. More than 3800 physicists, engineers, technicians, data analyzers, etc. of various sorts are actively involved in CMS, and more than 3000 in ATLAS. Some operate on-site but many operate remotely through the Worldwide LHC Grid. 42 countries and 182 institutes are actively involved in CMS, and 38 countries and 174 institutes in ATLAS. On July 4, 2012, the collaborations announced that their 2011 and 2012 results constitute strong evidence for the existence of the Higgs boson, the fundamental particle that gives mass to other fundamental particles. Arriving at the knowledge that Higgs particles exist involves the epistemic labour of, and inter-dependence between, many individuals with diverse expertise. This is a radically different picture of science than that suggested by the

Royal Society of London's maxim, which to this day remains, "nullius in verba," meaning, "take nobody's word for it."[4]

The question of who can possess EIK was considered some time ago by John Hardwig (1985). He identified two options:

1. **Epistemic Autonomy**: to possess knowledge, a subject must possess all the epistemic materials generating it; so, EIK can be possessed only by the *group* subject across which epistemic materials extend.
2. **Epistemic Extension**: a subject can possess knowledge when other subjects possess some of the epistemic materials generating it; so, EIK can be possessed by *individual* subjects. That is, individuals can have *extended knowledge*.

The latter option is what Hardwig dubbed "vicarious knowledge" (1985, 344, 348) — individually possessed, collectively produced. Hardwig favoured option (1) of his dilemma. It is a dilemma because one of two traditional tenets in epistemology must be abandoned to permit EIK: only individuals can possess knowledge, or knowledge-bearers must be epistemically autonomous. Hardwig's intuition in favour of the latter was stronger: if the only plausible autonomous knowledge-bearer is a group, the knowledge-bearer is a group.[5]

The claim that groups can have knowledge is endorsed by many more philosophers today than when Hardwig wrote in 1985.[6] Like Hardwig, several of these philosophers reason as follows: if the epistemic materials generating knowledge extend beyond any individual, this knowledge is group knowledge (Bird 2014; Vaesen 2011a; de Ridder 2014). Yet, they endorse this line of reasoning more boldly than Hardwig did, fashioning it into what I call *the argument from EIK to group knowledge*. Unlike Hardwig, these philosophers merely assume that epistemic autonomy is a necessary condition for possessing knowledge, failing to recognize epistemic extension as an alternate analysis of EIK. Given this assumption, each instance of EIK must be an instance of group knowledge. No philosopher I am aware of espoused epistemic extension when Hardwig wrote in 1985.

Yet, Hardwig recognized it as a viable alternative to epistemic autonomy (348-9). Today, a fair number of philosophers espouse epistemic extension. So, it is fair to say that proponents of the argument from EIK to group knowledge err by overlooking epistemic extension as an alternate analysis of EIK.[7]

Granted, epistemic extension is a radical idea, since the idea that epistemic autonomy is necessary is deeply embedded in the mainstream epistemological tradition. But as Hardwig rightly notes, the idea that groups can possess knowledge is also radical in this sense. Still, the diverse accounts predicated upon or entailing epistemic extension were formulated independently, without a common term like "epistemic extension," and with little connection to Hardwig's work. So, it is not immediately obvious that they are all linked by the same underlying principle and that each analyzes EIK in a manner following option (2) of Hardwig's dilemma. Given this, and given there is no survey in the literature, I offer a survey of epistemic extension in section 1. Clarifying epistemic extension and showing it is a viable and increasingly espoused principle sets up my argument in section 2 that epistemic extension undercuts the argument from EIK to group knowledge. That is, EIK underdetermines group knowledge: knowledge generated by epistemic materials extending beyond any individual is not automatically group knowledge. If any instance of knowledge is EIK, it is an occasion for scrutinizing the traditional idea that epistemic autonomy is necessary for possessing knowledge, not just the traditional idea that only individuals can possess knowledge. Hardwig recognized this but proponents of the argument from EIK to group knowledge do not.

So, what I show in section 2 is that Hardwig's dilemma still stands. In section 3, I argue that, of the two options, (2) is preferable. That is, some cases are best analysed as extended knowledge.[8] To show this, I need not deny the possibility of group knowledge. While I contend that *one* argument for group knowledge fails — the argument from EIK —

there are independent reasons in favour of ascribing knowledge to groups. Since Hardwig wrote in 1985, there have been various proposals in group ontology that offer ways of individuating group epistemic subjects, ways beyond merely tracking those who possess the epistemic materials generating knowledge. Some propose that groups can be ascribed with beliefs or acceptances that, like individual doxastic states, can satisfy the remaining conditions on knowledge. Others propose that a group can be the type of agent or even person that constitutes a proper epistemic subject.[9] In section 3, I recast Hardwig's dilemma at the group level. There appear to be special cases of EIK in which epistemic materials generating it extend beyond any individual and also beyond any group to which we can reasonably ascribe beliefs, acceptances, agency, personhood, etc. That is, in some cases, epistemic materials extend over transient groups which are not picked out by available methods for individuating group epistemic subjects. Call this *extra-group knowledge* (EIK-G), a subset of EIK. The options available for analyzing EIK-G are the same as those identified by Hardwig for analyzing EIK. According to option (1), epistemic autonomy is necessary for possessing knowledge; so, EIK-G can be possessed only by the transient groups across which epistemic materials are distributed. According to option (2), a subject can possess knowledge while relying on others for some of the epistemic materials generating it; so, EIK-G can be possessed by subjects (individuals or groups) who depend on others for epistemic materials. Groups to which we can reasonably ascribe beliefs, acceptances, agency, personhood, etc. are the groups picked out by option (2), not option (1). These are robust, persistent groups that can be involved in generating knowledge iteratively, not in one-off fashion. These are groups defined by more than the participation of multiple individuals in generating a particular case of EIK-G. If option (2) offers the preferable analysis for such cases, epistemic autonomy is not necessary for possessing knowledge. That is, some knowledge — at least EIK-G — is extended knowledge.

This is the paper's partisan conclusion. The central ideas I explore in this paper lend themselves to a second, neutral, and theoretical application. I conclude in section 4 by offering a novel framework for conceptualizing and organizing social and group epistemology: six possible combinations of views dividing epistemologists (fig.1). This framework also points to a new frontier in group epistemology. The bulk of group epistemology to-date can be classified as *intra*-group epistemology: analysis of epistemically salient happenings *within* groups. This new frontier is *inter*-group epistemology: analysis of epistemically salient happenings *between* groups. I aim to motivate its exploration.

1. A Survey of Epistemic Extension

Proponents of epistemic extension argue that individuals can be epistemically dependent on others in a more radical way than is traditionally permitted in epistemology, even after the externalist and social turns. While epistemic extension is an externalist principle, it is not implied by externalism. A central disagreement between internalists and externalists is about what counts as an epistemic material — about whether some epistemic materials are things other than states or exercises of the subject's inner life. Epistemic extension is not directly about what kinds of things epistemic materials are. It is about who possesses them. Most epistemologists, including most externalists, maintain that the knowledge-bearing subject must bear all epistemic materials. They retain the claim that epistemic autonomy is necessary for possessing knowledge. In response to several famous problems, externalists retreated to the confines of the individual subject's cognitive apparatus, ruling out EIK. According to agent reliabilism, for example, epistemic materials are confined to the individual subject's cognitive processes (or dispositions). Proponents of more recent causal conditions on knowledge take all salient causes to be constitutive of the individual subject's cognitive apparatus. The common position among epistemologists, including externalists, is

that cognitive operations of others involved in *S* coming to know that *p* are not epistemic materials. Instead, knowledge possession implies the possession of all epistemic materials. That is, epistemic autonomy is necessary for possessing knowledge.[10]

So, there are really two kinds of externalism at play: one according to which the individual subject's external states can constitute epistemic materials, and another according to which some epistemic materials cannot be ascribed to the individual. The latter is epistemic extension. Alvin Goldman, whose work has been central for both the externalist and social turns in epistemology, indirectly helps clarify this distinction:

> A justified belief is, roughly speaking, one that results from cognitive operations that are generally speaking, good or successful. But "cognitive" operations are most plausibly construed as operations of the cognitive faculties, i.e., "information-processing" equipment internal to the organism. (1979, 187)

What Goldman expresses up to "i.e." involves a claim about what sorts of things count as epistemic materials: cognitive operations. What follows "i.e." suggests two further constraints. The first rules out the cognitive operations of others; it rules out epistemic extension in favour of epistemic autonomy. The second is that epistemic subjects are individuals; it rules out group knowledge, restricting knowledge possession to individuals.[11]

Sanford Goldberg, a central proponent of epistemic extension, rightly points out that most externalists understand the cognitive operations of others involved in an individual subject *S* arriving at testimonial belief as features of *S*'s belief-generating environment, relative to which *S*'s testimonial belief is appraised, but not as part of the belief-generating process itself (2010, 36).[12] Most epistemologists of testimony, reductionists and non-reductionists alike, take the scope of appraisal of testimonial belief to range over the testimonial exchange itself. The scope of appraisal is not taken to extend over the earlier formation of the testifier's belief or assertion that *p*, which consists of epistemic materials located perhaps a minute, a day, a week, a month, a year, or even further in the past. Yet,

Goldberg argues that the formation of the testifier's belief is often a salient part of why the recipient of testimony arrives at the truth. If the normativity required for knowledge includes concern with the propensity to arrive at the truth, then the testimonial exchange is only the terminal phase of the testimonial-belief-generating process. Epistemological appraisal ought to extend over the formation of the testifier's belief (ch.4). In other words, some knowledge is EIK, and since it can be possessed by individuals, some knowledge is extended knowledge. Goldberg directly endorses epistemic extension.[13]

Many philosophers contend, or their models imply, that denying the possibility of EIK comes at a high skeptical price: many cases of what we want to call knowledge are not really knowledge.[14] Several of these philosophers agree with Goldberg's (2010; 2011; 2012) underlying idea that the epistemic materials involved in a testimonial exchange itself often cannot satisfy the normativity required for knowledge, and so the scope of epistemological appraisal must extend beyond the testimonial exchange.[15] This means testimonial knowledge is often generated by the epistemic materials involved in a testimonial exchange plus those (past) materials ascribed to the testifier. Epistemic extension bridges the gap.

Boaz Miller (2015), for example, argues that sometimes when we want to say individual *S* knows that *p*, things could too easily have gone wrong in ways opaque to *S* (§V). Miller points to a famous episode in science history (§IV). Arthur Eddington's 1919 experiments involved two expeditions, one to Sobral, Brazil and the other (which Eddington accompanied) to the island of Principe, off the coast of West Africa. Images of the Hyades open cluster in the constellation Taurus were taken by both teams during the solar eclipse of May 29, 1919, when the eclipsed sun moved across the cluster. These were imposed on images of the cluster taken at night. Eddington concluded that the degree to which the Sun's gravity disturbed passing starlight aligned with Einstein's predicted values, not Newton's. However, according to Earman and Glymour (1980), Eddington discarded salient data that

was less supportive of his conclusion. Suppose this undercuts the justification of Eddington's conclusion (Collins and Pinch 1993, 43-54; Waller 2002: ch.3). Miller has us consider Hyde, who correctly believes *via* a report of Eddington's conclusion that general relativity is correct. Contrast Hyde with Jekyll, who has an identical belief *via* an identical report but resides in a close possible world in which Eddington faithfully performed the experiments, and in which Eddington's conclusion lent sufficiently similar support to general relativity. The problem is that the recipient of testimony often cannot determine whether they are in a Hyde-like or Jekyll-like scenario; whether undercutting misconduct occurred is opaque to them. Miller points to data suggesting that Hyde-like scenarios are common, even in science (426-7).[16] Rather than allow the possibility of Hyde-like scenarios to undercut epistemic success attained through Jekyll-like scenarios, Miller proposes the principle, Knowledge-Level Justification Communalism, a version of epistemic extension:

> …whether some of the true beliefs that *S* holds are sufficiently justified to amount to knowledge… depends on evidence (or other building blocks of which epistemic justification consists) which *S* does not possess or are not situated within *S*'s own cognitive system, but are possessed by, or situated within the cognitive systems of other relevant members of *S*'s epistemic community. (419)

Much of the support for epistemic extension surveyed thus far is negative: reasons to reject epistemic autonomy as a necessary condition for possessing knowledge.[17] Yet, some epistemologists offer positive explications of extended knowledge. These include several epistemologists of cognitive externalism, particularly of extended cognition.[18] According to extended cognition, cognition can extend 'outside the head', over artifacts, environmental features, and other subjects. When an individual comes to have knowledge *via* extending her cognition over the cognitive efforts of others, she does not possess all epistemic materials. In such cases, epistemic extension obtains. I say this is a positive explication of extended knowledge because it is a specific, psychological characterization of what is

fundamentally an epistemological phenomenon. Furthermore, a minimal condition is placed on an individual *S* who depends on others for epistemic materials: all epistemic materials must fall within the scope of *S*' extended cognition.[19]

Berit Brogaard (2014, 57-60) further specifies this condition on *S*: *S* must *responsibly* extend her cognition over the cognitive efforts of others. Like Lackey (2007; 2009) and Vaesen (2011b), Brogaard rejects credit theories, according to which *S* justifiably believes that *p* only if *S* is creditable for truly believing that *p*, that is, only if all epistemic materials are creditworthy contributions of *S*. Brogaard contends that credit theories cannot make sense of cases in which cognition, and therefore credit, extends beyond *S*. She proposes that when *S* is not creditable with all epistemic materials, *S* can still possess knowledge by satisfying a responsibilist condition on her relationship to epistemic materials contributed by others.[20]

Adam Green (2012; 2014), on the other hand, aims to rescue credit theory by extending it. Citing Goldberg's work, Green conceives of a credit theory that characterizes all epistemic materials as creditworthy contributions but also permits *S* to possess knowledge when depending on others' creditworthy contributions. Although Green and Brogaard disagree about credit theory, they agree that an individual can possess knowledge without possessing all epistemic materials. Thus, both their views entail epistemic extension.[21]

While extended cognition has received most attention, Ronald Giere (2002; 2006; 2007; 2011; 2012) has long defended a model employing distributed cognition.[22] In cases of both extended and distributed cognition, cognitive labour extends beyond any one individual. But in cases of distributed cognition, there is no central individual. Giere's main example is Ed Hutchins' (1995) famous study of navigation. Giere agrees with Hutchins that the cognitive labour involved in many naval operations, such as a ship entering port, is

necessarily distributed across large, complex, organized systems that cannot be internalized by any individual,

> [T]here are sailors on each side of the ship who telescopically record angular locations of designated landmarks relative to the ship's gyrocompass. These readings are then passed on by the ship's telephone to the pilothouse, where they are combined by the navigator on a specially designed chart to plot the location of the ship. In this system, no one person could possibly perform all these tasks in the required time interval. *And only the navigator, and perhaps his assistant, knows the outcome of the task until it is communicated to others in the pilothouse. Those recording the locations of landmarks have no reason to know the result of the process.* (Giere 2007, 313-4, emphasis mine)

Giere resists the claim that knowledge ought to be ascribed to the group or, as Knorr-Cetina (1999) and Vaesen (2011a) claim, to the ship as a whole: crew plus artifacts. Rather, it is the navigator, and maybe her assistant, who knows. Giere aims to avoid what he deems unnecessary, inflated social ontology, or "extended epistemic agency," which he targets more pointedly in Giere (2007). As such, his view entails epistemic extension, according to which an individual can possess knowledge without possessing all epistemic materials.

Some proponents of epistemic extension offer mostly negative motivation toward epistemic extension and away from epistemic autonomy.[23] Others offer positive, psychological explications of extended knowledge.[24] Others still are more narrowly concerned with placing conditions on an individual beneficiary *S* of epistemic materials possessed by others.[25] There is much left to explore about the nature of extended knowledge. This is a major frontier in social epistemology.

2. Reinstating Hardwig's Dilemma

There is a group of philosophers who agree with proponents of epistemic extension that the normativity required for knowledge must sometimes be satisfied by multiple subjects.

However, these philosophers take it that knowledge generated this way must, therefore, be group knowledge (Vaesen 2011a; Bird 2014; de Ridder 2014). That is, the occurrence of EIK is taken to entail group knowledge. In this section, I argue that epistemic extension undercuts this argument from EIK to group knowledge. Hardwig (1985) showed there are *two* ways to analyze EIK. Since epistemic extension is viable, EIK underdetermines group knowledge. When analyzing EIK, it should not be merely assumed that epistemic autonomy is necessary for knowledge.

Consider Jeroen de Ridder's (2014) account of justification for scientific knowledge (SJ). According to his account, subject *S*'s belief that *p* satisfies (SJ) only if (1) *p* is properly based on a scientific process of inquiry, (2) which is directed at deriving evidence for *p*, (3) is properly performed, and (4) objectively reliable (43-4); furthermore, (5) *S* must understand that conditions (1) through (4) obtain (44-45). de Ridder argues that sometimes "only a collective can satisfy (SJ)" (48). He claims that sometimes both the construction of the scientific process of inquiry upon which a research project is based, and the proper performance of that process, necessarily involve the cognitive contributions of many scientists with diverse expertise (46-7). Thus, conditions (1) and (3) can sometimes be satisfied only collectively. Furthermore, the monitoring required to ensure that the process is directed toward deriving evidence for *p* sometimes exceeds the abilities of any individual and so must be distributed among multiple individuals, each with the expertise appropriate for monitoring a particular part of the process (47-8). Likewise, sometimes no individual can understand that (1) through (4) obtain. Thus, conditions (2) and (5) can sometimes be satisfied only collectively. Necessary distribution of cognitive labour towards satisfying (SJ) is particularly vivid in large-scale cases, such as the experiments housed at CERN's LHC and efforts of the Intergovernmental Panel for Climate Change (IPCC) (46). In such cases, "no individual scientist has the cognitive resources to oversee all the epistemically relevant

aspects of the research project that she—or: her team or community—is engaged in" (37-38). Any knowledge generated by distributed epistemic materials is EIK.

However, de Ridder infers from the claim "that there is an important sense in which scientific justification can indeed only be had by a collective" that "much scientific knowledge is collective knowledge" (45). Recall Hardwig's two options for analyzing EIK: (1) EIK must be group knowledge, since epistemic autonomy is necessary for possessing knowledge, or (2) epistemic extension is permitted, so EIK can be possessed by individuals. While an increasing number of epistemologists agree with Hardwig that some knowledge is EIK[26], and that group knowledge sometimes obtains[27], de Ridder and others (Vaesen 2011a; Bird 2014) forward an argument directly from the former to the latter: EIK must be group knowledge. The conclusion of this argument from EIK to group knowledge follows only if epistemic autonomy is necessary for possessing knowledge. But proponents of this argument *assume* rather than show this. Hardwig himself only tentatively endorsed option (1). He claimed only that his intuition in favour of epistemic autonomy was stronger than his intuition in favour of the claim that only individuals can have knowledge (348-9). His more immediate concern was with posing a dilemma about how to analyze EIK. No philosopher I am aware of espoused epistemic extension when Hardwig wrote in 1985. Yet, Hardwig rightly recognized it as a live option. Today, a fair number of philosophers espouse epistemic extension. So, it is fair to say that proponents of the argument from extended justification err by overlooking epistemic extension as an alternative analysis of EIK.

Interestingly, de Ridder claims that an individual can possess "derivative" or "secondary" knowledge that *p* when "she doesn't have access to all of that non-testimonial evidence herself, because it is partly beyond her cognitive reach… [when] she doesn't fully understand all the evidence for p and how it supports *p*…" (48-49). Proponents of epistemic extension agree that such an individual does not herself possess all epistemic materials.

They agree that any individual knowledge generated this way "derives from the collective," since this just means *S* cannot alone satisfy (SJ). So, de Ridder seems to allow for some extended knowledge. But other proponents of epistemic extension would be right to request further reasons for invoking group knowledge in addition to this extended individual knowledge, since the mere occurrence of EIK underdetermines group knowledge. Melinda Fagan (2012, 829) puts the point nicely,

> The moral is not to abandon the idea of collective scientific knowledge, but to focus on aspects of inquiry that include epistemically significant interactions among individuals. Crucial roles of groups in scientific knowledge-production can be illuminated without supposing that groups themselves have scientific knowledge.

de Ridder does consider whether he has "only shown that the *production* of scientific knowledge often irreducibly involves collectives, not that knowledge can properly be *attributed to* or *had* by collectives" (51). But he thinks this objection "assumes that collectivity in the production of knowledge is somehow eliminable once the knowledge is produced and attributed to a subject… Since having scientific knowledge requires satisfying (SJ), the collective primarily has scientific knowledge." (*ibid*). That is, since collectivity in satisfying the normative conditions on knowledge cannot be eliminated, the group must have knowledge. But proponents of epistemic extension deny that epistemically extended knowledge entails the elimination or reduction of collectivity in generating knowledge. The very point of epistemic extension is that individuals can possess collectively generated knowledge. de Ridder's reply to this objection works only if knowledge possession entails the possession of all epistemic materials. So, his reply assumes epistemic autonomy is necessary for knowledge. Again, this begs the question against option (2) of Hardwig's dilemma, which is the option proposed by de Ridder's objector.[28]

Others less directly forward the argument from EIK to group knowledge. Krist Vaesen (2011a) rejects Giere's proposal that knowledge can be ascribed to individuals when

epistemically salient cognitive labour is distributed across groups or systems. Concerning Hutchins' (1995) example of a ship navigating into port, Vaesen observes that "there is no crew member who has internalized all relevant knowledge and skill" (382). Furthermore, certain social relations are salient for successful navigation:

> A group of people with the same individual knowledge base but organized differently (say, hierarchically versus horizontally) will perform differently at a given cognitive task. Simply adding up properties of individuals, thus, will not account for success or failure; instead, we need to consider the wider socio-technical system. (382-3)

From this Vaesen infers that "[i]t is the system as a whole (crew plus artifacts) that knows" (383). He claims that for an individual subject *S* to have knowledge, all epistemic materials "must pass through [*S*'] human cognitive engine (for purposes of interpretation and justification)" (385). However, there is often no such subject *S* "who has internalized" (382) all epistemic materials. Vaesen takes this to mean that *S* cannot possess knowledge. Yet, epistemic extension is directly opposed to the requirement that all epistemic materials, whether distributed across individuals or a system, "must pass through [*S*'] human cognitive engine (for purposes of interpretation and justification)." Instead, individuals can have knowledge without having all epistemic materials.[29]

Alexander Bird (2014) is also critical of Giere. He associates Giere's position with Karl Popper's (1979, 109) claim that "knowledge in the objective sense is knowledge without a knower — knowledge without a knowing subject" (quoted in Bird, 58). By "knowledge in the objective sense," Popper is referring to cases in which no subject can possess sufficient evidence. He contends that no one possesses EIK — not individuals, groups, or systems. Giere and other proponents of epistemic extension disagree. They claim that individuals can, in principle, possess EIK. Yet, in objecting to Giere's analysis, Bird contends that "[i]t does not sound at all odd to assign epistemic properties to such [wider] entities" (59). But no proponent of epistemic extension contends that groups cannot be ascribed with

epistemic properties because they are not ascribed with knowledge. This is a mischaracterization of Giere's view.[30]

Proponents of epistemic extension and proponents of the argument from EIK to group knowledge agree that some knowledge is EIK. Unlike Hardwig, proponents of the argument from EIK overlook an alternate analysis of EIK (de Ridder 2014; Vaesen 2011a; Bird 2014). They do not offer reasons for invoking group knowledge rather than (or in addition to) extended individual knowledge.

3. Recasting Hardwig's Dilemma at the Group Level

I have shown that epistemic extension undercuts the argument from EIK to group knowledge, that epistemic extension remains a live option for analyzing EIK. This brings us back to square one, to the options Hardwig originally laid out in 1985 for analyzing EIK. In this section I argue that if some knowledge is EIK, as a large and growing number of philosophers contend, option (2) of Hardwig's dilemma offers the preferable analysis. That is, if there is EIK, epistemic autonomy is not necessary for possessing knowledge. Rather, some knowledge is extended knowledge.[31] However, this argument does not require one to deny the possibility of group knowledge. Indeed, I argue in this section that when Hardwig's dilemma is recast at the *group* level, option (2) is preferable. These are special cases of EIK in which epistemic materials extend beyond any individual and also beyond any group involved in generating knowledge.[32]

While the argument from EIK to group knowledge fails, there are other arguments for group knowledge. One class of these can be called *the argument from group ontology*. Since Hardwig wrote in 1985, there has been much work in group ontology. Some propose that groups can be ascribed with doxastic or doxastic-like states (e.g. beliefs, acceptances) that, like individual doxastic states, can satisfy the conditions on knowledge. Others propose

that a group can be the type of agent or even person that constitutes a proper epistemic subject.[33] Just one example is the joint commitment view of group belief, according to which a group can have a belief that is irreducible to the individual beliefs of its membership.[34] A common example is a hiring committee that determines Jane is the best candidate even though no individual member of the committee believes Jane is the best candidate. This occurs because the committee's decision procedure is to average each individual committee member's ranked list of candidates. The winning candidate, Jane, has the highest average rank without being at the top of any individual member's list. Joint commitment accounts typically include a normative bind between group members who each commit to not contravene the group's view. In such cases, a complete description of a group's belief must include something in addition to the individual beliefs of a group's individual members (de Ridder, 40). A description of the hiring committee's belief includes the fact that the committee's membership jointly commits to the result of the group's decision procedure.

Suppose group beliefs can satisfy the normative conditions on knowledge, or that some other version of the argument from group ontology succeeds. This gives us reasons other than the mere occurrence of EIK for invoking group knowledge. However, I show that there are cases of knowledge in which epistemic materials extend beyond any individual and also beyond any group to which we can reasonably ascribe beliefs, acceptances, agency, personhood, etc. So, in such cases epistemic materials extend beyond any group picked out by available methods for individuating group epistemic subjects. These are cases of *extra-group knowledge* (EIK-G), a subset of EIK. In any case of EIK, epistemic materials extend beyond any individual. In cases of EIK-G specifically, epistemic materials also extend beyond any neatly-individuated group. For such cases, we have the options Hardwig proposed for analyzing EIK. According to option (1), epistemic autonomy demands that the knowledge-bearer is identical to the bearer of all epistemic materials. This means EIK-G

must be ascribed to extended, awkwardly-individuated, transient groups that generate knowledge in one-off fashion. On the other hand, option (2) permits epistemic extension, which permits us to ascribe EIK-G either to epistemically dependant individuals or to epistemically dependant, though robust and persistent, groups that can be generate knowledge iteratively. Groups to which we can reasonably ascribe beliefs, acceptances, agency, personhood, etc. are the groups picked out by option (2), not option (1). So, in cases of EIK-G, the argument from group ontology supports option (2), not option (1). If some knowledge is EIK-G, option (2) offers the preferable analysis. This means epistemic autonomy is not necessary for possessing knowledge — that some knowledge is extended (individual or group) knowledge.[35]

On July 4, 2016, NASA's Juno spacecraft arrived at Jupiter. One of its many instruments is the JunoCam. The majority of this camera's targets are chosen by the public and data retrieved is analyzed partly by the public.[36] For at least some knowledge generated through use of the JunoCam, the collection of subjects contributing epistemic materials extends beyond NASA's Juno team. If we endorse option (1), the knowledge-bearing subject is the combination of NASA's Juno team of astrophysicists, professional data analyzers, engineers, technicians, etc., plus a loosely connected and extensive collection of amateur astronomers and data analyzers. Some of the latter may even be anonymous. They may include pairs or trios offering analyses under a single online pseudonym. It may be impractical or impossible to specify the group that possesses knowledge. Knowledge-generating labour seemingly extends not just beyond any individual, but also beyond any neatly-individuated group. If so, this is a case of EIK-G. If we instead endorse option (2), permitting epistemic extension, we can ascribe knowledge to a well-defined, structured, specialized, and persistent group — NASA's Juno team — while respecting the epistemically salient contributions of those not constitutive of it. Small, structured, and specialized

research teams are paradigmatic candidates for possessing knowledge. Loosely defined, extensive, and transient groups are not.[37]

Consider another case. A jury finds the defendant, Colonel Mustard, not-guilty of committing murder. Among all the evidence deliberated upon by the jury, some salient evidence is received from several expert witnesses: a clinical psychiatrist, a blood spatter analyst, and a forensic expert in firearms. None of the expert witnesses walks the jury, step-by-step, through all her technical work. This would require each juror to complete the training and education required to become an expert. Instead, each expert witness offers a layperson summary of her work to the court. Suppose the totality of evidence satisfies the normative conditions for knowledge that Colonel Mustard is not guilty. Assuming that no individual can possess all epistemic materials, this is EIK. According to option (1) of Hardwig's dilemma, the jury cannot possess this knowledge because the jury does not possess all the epistemic materials generating it. Knowledge is instead possessed by the group constituted by the jury plus the expert witnesses, since this is the only group that can satisfy the epistemic autonomy condition on knowledge possession. As in the previous case, knowledge-generating labour seemingly extends beyond any neatly-individuated group. If so, this is EIK-G. By instead endorsing option (2) — permitting epistemic extension — one can ascribe knowledge to the jury without failing to acknowledge the epistemically salient contributions of the expert witnesses.

On the group-level version of Hardwig's dilemma, one deliberates about whether to ascribe knowledge to a research team or to the research team plus non-members; one deliberates about whether to ascribe knowledge to a jury or to the jury plus expert witnesses. Option (1) at this level ascribes knowledge to transient groups defined largely by the participation of more than one individual in generating a particular case of EIK-G. On the individual-level specification of Hardwig's dilemma, one deliberates about whether to

ascribe knowledge to an individual scientist or to a research team; one deliberates about whether to ascribe knowledge to a single juror or to a jury. Option (1) at this level ascribes knowledge to groups with more substantive and persistent identities. So, option (1) is independently less attractive at the group level than it is at the individual level.

Additionally, the argument from group ontology to group knowledge picks out the same groups option (2) picks out, not the groups option (1) picks out. Thus, proponents of option (2) can find additional support in the argument from group ontology. Recall the joint commitment version of the argument from group ontology. Only the commitments of the jury's members constitute the jury's view. Only members of the jury jointly commit to its decision procedure, to its outcome, and to not contravene the outcome once it is delivered. Indeed, jury members are prohibited from commenting on the trial. No witness, attorney, or judge partakes in the jury's decision procedure or is committed to not contravene the jury's decision. A witness, attorney, or judge can oppose the jury's decision. A witness might be free to comment on the trial. An attorney can file an appeal. A judge can write a dissenting opinion. According to option (1), the group that knows Colonel Mustard is not guilty is the jury plus expert witnesses, since this is the group that contributes epistemic materials. According to option (2), the group that knows Colonel Mustard is not guilty is the jury. Option (2) and the joint commitment view of group belief pick out the same group.

Yet another reason to favour option (2) at the group level is that epistemic extension can be independently more plausible at the group level than at the individual level. Goldberg (2010) shows that individual recipients of testimony can be dependent on others' epistemic materials. He argues that whether a recipient of testimony arrives at the truth often depends on the justification-basis of the testifier's belief or assertion. The same reasoning applies at the group level. In order to determine whether a group *G*'s testimonial belief (or acceptance) amounts to knowledge, appraisal ought to extend over epistemic

materials that cannot be ascribed to *G*. All we need to accept is that groups (e.g. juries) can receive testimony (e.g. from expert witnesses). So, Goldberg's argument for extended individual knowledge is easily reformulated into an equally-compelling argument for extended group knowledge.[38]

Miller's (2015) argument for invoking extended individual knowledge is *stronger* when reformulated into an argument for extended group knowledge. This is the case if the normative conditions on group knowledge are more difficult to satisfy than the normative conditions on individual knowledge. This claim is defended by several philosophers.[39] For example, just one of Jennifer Lackey's conditions for a group *G* justifiably believing that *p* is that "[a] significant percentage of the operative members of G… justifiably believe that *p*" (381). Recall Miller's (2015) argument and data showing that sometimes when we want to say individual *S* knows that *p*, things could too easily have gone wrong in ways opaque to *S* (§V). That is, Hyde-like scenarios are relatively common, even in science. Epistemic extension prevents the possibility of Hyde-like scenarios from undercutting the epistemic success attained through Jekyll-like scenarios. If a necessary condition for group *G* justifiably believing that *p* is that a "significant percentage of the operative members of *G*" must each justifiably believe that *p*, then things could go wrong in many more ways that are opaque to *G* than it can wrong in ways opaque to any one of its operative members *S*. For any given operative member *S*' belief that *p*, there is the possibility of a Hyde-like scenario. For the group *G*'s belief that *p*, that possibility is perhaps as many times more likely as whatever number equals a "significant percentage of operative members of *G*." If we resist epistemic extension, group knowledge is possible only if a significant percentage of *G*'s operative members can determine whether they are in a Hyde-like or Jekyll-like scenario. So, if we need epistemic extension to prevent the occurrence of Hyde-like scenarios from undercutting the epistemic success attained through Jekyll-like *individual* beliefs, then we

surely need epistemic extension to prevent the occurrence of Hyde-like scenarios from undercutting the epistemic success attained through Jekyll-like *group* beliefs (or acceptances, results, etc.).

So, option (1) is independently less plausible at the group level because it ascribes knowledge to transient groups. It is less plausible still because it identifies different groups as knowledge-bearers than those identified by the argument from group ontology. A third reason to favour option (2) is that epistemic extension can be independently more plausible at the group level than at the individual level. When recast at the group level, option (2) of Hardwig's dilemma is preferable. This means if there is EIK-G, epistemic autonomy is not necessary for possessing knowledge. It means some knowledge is extended (individual or group) knowledge.

4. A New Framework & A New Frontier

In this paper, I show that one argument for group knowledge — the argument from EIK — assumes the necessity of epistemic autonomy for possessing knowledge and fails to interact with the alternative analysis — epistemic extension — which Hardwig identified back in 1985. In other words, I show that Hardwig's dilemma still stands. Second, I recast Hardwig's dilemma at the group level and show that option (2) offers a preferable analysis of special cases of EIK. If there are such cases, epistemic autonomy is not a necessary condition for possessing knowledge. This is the paper's partisan conclusion. In this section, I conclude with a neutral proposal. I employ the ideas explored in this paper to generate a novel framework for conceptualizing and organizing social and group epistemology (fig.1). This framework also points to unexplored possibility space in group epistemology.

Hardwig's dilemma entails that at least one of two traditional, individualistic tenets in epistemology must be abandoned: the necessity of epistemic autonomy for knowledge, or

the idea that knowledge is possessed by individuals, not groups. One can endorse the non-traditional claim that groups can possess knowledge while retaining the traditional claim that epistemic autonomy is necessary for knowledge. This combination of group knowledge and epistemic autonomy is employed by proponents of the argument from EIK to group knowledge. de Ridder (2014) is an interesting case, since he allows for some extended individual knowledge. Yet, for de Ridder, it seems extended individual knowledge necessarily "derives from the collective," which is "the primary subject of knowledge in these cases" (50). In other words, there must always be a bearer of autonomously generated knowledge, and when it cannot be an individual, it must be a group.

Alternatively, one can retain the traditional claim that only individuals can possess knowledge and simultaneously endorse the non-traditional claim that knowledge can be generated *via* epistemic extension. The combination of individual knowledge and epistemic extension is employed by all proponents of epistemic extension I am aware of beside de Ridder. None but de Ridder also invokes group knowledge.[40]

Here is another, virtually unexplored combination I identified in section 3: one can endorse the non-traditional claim that groups can possess knowledge and also endorse the non-traditional claim that knowledge can be generated *via* epistemic extension. This combination permits extended group knowledge, not just extended individual knowledge.

The distinctions between individual knowledge and group knowledge, epistemic autonomy and epistemic extension, and internalism and externalism run orthogonally to one another for the most part, generating six distinct combinations of views (fig.1):

fig.1

	Epistemological Internalism	**Epistemological Externalism**	
	Epistemic Autonomy		**Epistemic Extension**
Individual Knowledge/ Subjecthood	Individual subject *S* possesses knowledge that *p*, and all epistemic materials are internal states or exercises of *S*.	Individual subject *S* possesses knowledge that *p*, and all epistemic materials are internal or external states or exercises of *S*.	Individual subject *S* possesses knowledge that *p*, and some epistemic materials are internal or external states or exercises of subjects beside *S*.
Group Knowledge/ Subjecthood	Group subject *G* possesses knowledge that *p*, and all epistemic materials are internal states or exercises of *G*.	Group subject *G* possesses knowledge that *p*, and all epistemic materials are internal or external states or exercises of *G*.	Group subject *G* possesses knowledge that *p*, and some epistemic materials are internal or external states or exercises of subjects beside *G*.

Mainstream epistemology has explored only two of six combinations of views (marked yellow). The increasingly popular claim that group knowledge sometimes obtains opens-up two new combinations of views (marked blue). Yet, if epistemic autonomy is assumed and epistemic extension is overlooked, two additional combinations are neglected (marked green).

In response to the argument from EIK to group knowledge, I claim that the combination of individual knowledge and epistemic extension is neglected. But this leaves one more combination of views: group-level epistemic extension. This is the combination of views I forwarded in section 3 for analysing EIK-G. A good deal of the literature cited in this paper, and the bulk of group epistemology to-date, can be classified as *intra*-group epistemology: concern for epistemically salient happenings within groups (marked blue).[41] The argument in section 3 for extended group knowledge can serve to motivate *inter*-group epistemology: concern for epistemically salient happenings between groups.[42]

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Notes

[1] Normative properties are not epistemic materials. Rather, epistemic materials are subject to normative appraisal. So, for example, epistemic materials can stand in reliability relations but reliability properties are not epistemic materials. To conflate these is to conflate the explanandum/explanans distinction in epistemology. I thank Sandy Goldberg for prompting this clarification.

[2] e.g. Hardwig (1985); Schmitt (1994); Hutchins (1995); Thagard (1997; 2010); Knorr-Cetina (1999); Gilbert (2000; 2004); Kusch (2002); Giere (2002; 2006; 2007; 2011; 2012); Goldman (2004); Bouvier (2004; 2010); Tuomela (2004; 2011); List (2005); Mathiesen (2006; 2011); Fallis (2007); Wray (2007); Rolin (2008; 2010); Hakli (2011); Tollefsen (2002; 2015); Goldberg (2010; 2011; 2012); Vaesen (2011a); Fagan (2011; 2012); Dewitt (2012); Green (2012; 2013; 2014); Shieber (2013); Kelp (2013; 2014); Palermos (2013; 2016); Palermos and Pritchard (2013; 2016); Bird (2014); Brogaard (2014); de Ridder (2014); Lackey (2014); Carter (2015); Miller (2015) Palermos (2015; 2017); Wagenknecht (2016).

[3] In this paper, I do not endorse the claim that some knowledge is EIK. Rather, I explore the relation between certain fundamental ideas in epistemology with the idea endorsed by a growing number of philosophers that some knowledge is EIK. To this end, I assume the occurrence of EIK.

[4] For the original CMS and ATLAS results, see Chatrchyan *et. al.* (2012) and Aad *et. al.* (2012), respectively. The officially specified authors of these articles are "The CMS Collaboration" and "The ATLAS Collaboration," respectively, though lists of the 2900 and 2932 individual authors, respectively, are appended. For important results since 2012, see Aad *et. al.* (2015), which is a co-authored report of coordinated CMS and ATLAS measurements. The officially specified authors of this article are "The ATLAS and CMS Collaborations," though a list of the 5154 individual authors is appended.

[5] When considering epistemic extension, I focus mostly on reliance on epistemic materials possessed by other people. But what I say can apply, *mutatis mutandis*, to reliance on epistemic materials attributable to institutions, systems, or social practices. I thank Sandy Goldberg for prompting this clarification.

[6] e.g. Schmitt (1994); Hutchins (1995); Knorr-Cetina (1999); Gilbert (2000); (2004); Kusch (2002); Tollefsen (2002); (2015); Goldman (2004); Bouvier (2004); (2010); Tuomela (2004); (2011); List (2005); Mathiesen (2006); (2011); Fallis (2007); Wray (2007); Rolin (2008); (2010); Hakli (2011); Vaesen (2011a); Dewitt (2012); Palermos and Pritchard (2013); (2017); Bird (2014); de Ridder (2014); Lackey (2014); Carter (2015); Palermos (2015); (2017); Wagenknecht (2016).

[7] Proponents of epistemic extension include Thagard (1997; 2010); Giere (2002; 2006; 2007; 2011; 2012); Goldberg (2010; 2011; 2012); Fagan (2011; 2012); Green (2012; 2013; 2014); Shieber (2013); Palermos (2013; 2016); Kelp (2013; 2014); Brogaard (2014); Miller (2015). "Epistemic extension" is derived from Goldberg's (2010) "epistemic extendedness." It can apply to states other than knowledge but I talk mostly of knowledge in this paper. All proponents of epistemic extension cited above are concerned with knowledge ascribed to individuals, not groups. Some are only indirect proponents of epistemic extension. They endorse views entailing epistemic extension, such as certain views about extended cognition. Note that I am not saying Goldberg (2010) and certain others endorse extended cognition. Epistemic extension is an epistemological claim, not a psychological claim. I return to the relationship between epistemic extension and extended cognition later. I am also not saying that epistemic extension is opposed to the idea that some knowledge is group knowledge. I clarify this point later.

[8] "Extended knowledge," is used by some to refer only to knowledge *via* extended cognition. However, knowledge *via* extended cognition is just one possible type of knowledge *via* epistemic extension. So, the term, "extended knowledge," should be reserved for the more fundamental notion of extension, which is epistemological, not psychological. I return to this issue later in the paper. I reiterate that I am not in this paper endorsing the claim that some knowledge is EIK. Thus, my argument in for option (2) of Hardwig's dilemma is provisional.

[9] On these diverse issues and their epistemological imports, see Gilbert (1989; 1994; 2000; 2004); Toumela (1992; 2004); Mathiesen (2006); Wray (2001; 2003; 2007; 2014); Mathiesen (2006; 2011); List and Pettit (2006; 2011; 2012); Staley (2007; 2010); Hakli (2007; 2011); Rolin (2008; 2010); Andersen (2010); Beatty and Moore (2010); Bird (2010; 2014); Bouvier (2010); Baumann (2011); Fagan (2011; 2012); Briggs (2012); Cariani (2012); Briggs *et. al.* (2014); Cheon (2014); de Ridder (2014); Gilbert and Pilchman (2014); Kusch (2014); Pettit (2014); Tollefsen (2015); List (2016); Weatherall and Gilbert (2016); Smith (2018).

[10] Alston (1995, 11-12, 15-16) understands "proximate" causes of a belief, by which he means those located within the individual subject's cognitive apparatus, as the only epistemically salient ones. Some epistemologists maintain that epistemological appraisal is relative to belief-generating environments (e.g. Janet's perceptual beliefs are reliably formed relative to normal lighting conditions). An aspect of the social turn in epistemology extends this to stress the relevance of belief-generating *social* environments. But on such contextualist accounts, features of belief-generating environments are not epistemic materials. Rather, such accounts call for *contextual* appraisal of the epistemic materials involved. This does not imply epistemic extension.

[11] I am not claiming that Goldman (1979) had epistemic extension or group knowledge in mind at the time. I am only making use of this passage as expressing a common combination of views. Goldberg (2010, 121-2) employs the same passage for a similar purpose. More recently, Goldman (e.g. 2004; 2014) has endorsed the claim that there is group knowledge. In comments on an ancestor of this paper, Goldberg rightly pointed out to me that, strictly speaking and setting aside Goldman's own resistance to epistemic extension, the passage quoted from Goldman (1979) is technically consistent with epistemic extension. This is worth pointing out. I nevertheless think the passage is useful for clarifying the distinction between epistemic extension and externalism at large.

[12] Goldberg focuses on process reliabilists, who, contrary to epistemic extension, typically understand the cognitive operations of others as relevant for determining the local reliability of the testimonial process generating *S'* belief that *p* but not for determining its global reliability.

[13] Goldberg finds an uncontroversial analogue in memorial beliefs. *S* has a memorial belief that *p* when *p* is inferred from (or is otherwise saliently dependent upon) *S'* memory of her previously acquired belief that *q* (65-7, 85-6). If *S'* belief that *q* was faulty upon acquisition, so is *S'* present belief that *p*: garbage-in, garbage-out. Most epistemologists agree that the epistemic materials generating memorial beliefs extend across time. Goldberg argues that for some testimonial beliefs they (also) extend across agents. If so, *S* can have knowledge without having all epistemic materials. In all the epistemically relevant ways, a memorial belief can be just like an extended testimonial belief. In many cases in which *S* derives a memorial belief that *p* from *S'* previously acquired belief that *q*, the original epistemic materials that generated *S'* belief that *q* are opaque to *S*. Likewise, for an extended testimonial belief that *p*, the epistemic materials that generated the testifier's belief or assertion that *p* are opaque to the recipient. There is only one difference between these two kinds of cases: in the former, everything of epistemic importance happens in an individual subject's head; in the latter, it does not. To accept the uncontroversial model for memorial beliefs and, without additional argument, reject epistemic extension for some cases of testimonial belief, is to insist upon epistemic autonomy for its own sake.

Another process reliabilist proponent of epistemic extension is Joseph Shieber (2013), who calls for a general, extended reliabilist account of knowledge, according to which,

(1) Individuals are the primary bearers of knowledge.
(2) Some individual S knows that p iff
    a. p
    b. S believes that p, and
    c. S's belief that p was produced by a process that reliably produces true beliefs, where
(3) Such processes may include the properties and actions of agents other than S as well as properties of the environment (i.e., instruments, etc.). (290)

Shieber requires of process reliabilism "only that the notion of process be broadened to include genuinely social belief-forming processes" (290). Like Goldberg, he directly endorses epistemic extension.

[14] See Hardwig (1985); Schmitt (1994); Thagard (1997; 2010); Knorr-Cetina (1999); Giere (2002; 2006; 2007; 2011; 2012); Tuomela (2004; 2011); Staley (2007; 2010); Goldberg (2010; 2011; 2012); Fagan (2011; 2012); Green (2012; 2013; 2014); Palermos (2013); Palermos and Pritchard (2013); Shieber (2013); Kelp (2013; 2014); Briggs *et. al.* (2014); Brogaard (2014); Cheon (2014); Goldman (2014); Tossut (2014); Miller (2015).

[15] e.g. Hardwig (1985); Green (2013); Shieber (2013); de Ridder (2014, 47-8); see especially Miller (2015, 421-2). I take it that epistemic extension is consistent with each of the reductionist, non-reductionist, generation, and transmission views of testimonial justification. See Miller (2015) on this point.

[16] According to an anonymous survey of 3200 scientists published in *Nature* (Martinson *et. al.* 2005), 6% of scientists report "failing to present data that contradict one's own previous research," 12.5% report "overlooking others' use of flawed data or questionable interpretation of data," 13.5% report "using inadequate or inappropriate research designs," 15.5% report "dropping observations or data points from analyses based on a gut feeling that they were inaccurate," and 15.5% admit to "changing the design, methodology or results of a study in response to pressure from a funding source." Presumably, these results are subject to the underreporting phenomenon that psychologists have established as common for studies in which subject are asked to offer critical self-reports, even anonymously. Furthermore, mathematical journals have higher than expected rates of substantial errors that survive the peer-review process. Grcar (2010) and Nathanson (2008) separately argue that this problem has troubling epistemic consequences for the field. Frans and Kosolosky (2014) and Geist, Loweand, and Van Kerkhove (2010) argue for more stringent conditions under which mathematical knowledge can be acquired through testimony. Sismondo (2009) shows that ghost-writing is increasingly common. Miller also shows that Hyde-like scenarios are clearly not Gettier cases. In short, they are common, not coincidental, and involve blameworthy error, not luck (427-8).

[17] Goldberg (2010) does offer some positive motivation of epistemic extension in his meta-epistemology of reliabilism and of the nature of epistemic assessment.

[18] Two collections of essays concerned with the epistemology of cognitive externalism are *Philosophical Explorations* 15(2) (2012) and *Philosophical Issues* 24(1) (2014). For the relationship between epistemic internalism/externalism and cognitive internalism/externalism, see Carter *et. al.* (2014). Clark and Chalmers (1998) prompted discussion of cognitive externalism in the philosophy of mind.

[19] Goldberg (2010, 127-132) rightly points out that epistemic extension, being a strictly epistemological claim, does not imply extended cognition. So to be clear, I am not attributing commitment to cognitive externalism to Goldberg, Miller, or any proponent of epistemic extension besides certain epistemologists of cognitive externalism. Beside Green (2012; 2014), the proponents of cognitive externalism cited in this paper endorse epistemic extension only indirectly. They contend that an individual can know that *p via* extending her cognition over the cognitive efforts of others. Thus, their views on knowledge *via* extended cognition entail epistemic extension.

[20] In correspondence, Miller suggested a similar condition on *S*. Pritchard (2010), like Brogaard, argues that a version of virtue epistemology beside credit theory is compatible with cognitive externalism. Michaelian (2014) disagrees.

[21] See Vaesen (2011b; 2013), Kelp (2013; 2014), and Green (2014) for debate about extended credit theory. Kelp (2013; 2014) and Palermos (2016) also appeal to extended cognition. On their views, when *S* knows and extends her cognition over the cognitive efforts of others, epistemic extension obtains.

[22] Thagard's (1997; 2010) view is similar.

[23] Goldberg (2010); (2011); (2012); Fagan (2011; 2012); Shieber (2013); Miller (2015). As noted earlier, Goldberg (2010) does offer some positive motivation.

[24] Thagard (1997; 2010); Giere (2002; 2006; 2007; 2011; 2012); Green (2012; 2014); Kelp (2013; 2014); Brogaard (2014); Palermos (2013; 2016).

[25] Brogaard (2014) places a responsibilist condition on *S*. Green (2012; 2014) places a creditworthiness condition on *S*. Palermos (2014), Clarke (2015), and Wray (2018) compare, on the one hand, *S* extending her cognition over the cognitive efforts of other agents, and on the other hand, *S* competently employing or integrating herself with technology. Palermos argues that these scenarios can be epistemically analogous: in both cases, *S* can competently extend her cognition without having to double-check epistemic materials possessed by others. That is, how technology works need not be transparent to *S* in order for *S* to be able to use it properly. Analogously, the cognitive operations of others need not be transparent to *S* in order for *S* to benefit epistemically from them. Wray disagrees to some extent. He contends that *S* must take responsibility for all epistemic materials and that this is complicated in important ways when other agents, as opposed to technological artifacts, are involved.

[26] e.g. Hardwig (1985); Schmitt (1994); Hutchins (1995); Thagard (1997; 2010); Knorr-Cetina (1999); Gilbert (2000; 2004); Kusch (2002); Giere (2002; 2006; 2007; 2011; 2012); Goldman (2004); Bouvier (2004; 2010); Tuomela (2004; 2011); List (2005); Mathiesen (2006; 2011); Fallis (2007); Wray (2007); Rolin (2008; 2010); Hakli (2011); Tollefsen (2002; 2015); Goldberg (2010; 2011; 2012); Vaesen (2011a); Fagan (2011; 2012); Dewitt (2012); Green (2012; 2013; 2014); Shieber (2013); Kelp (2013; 2014); Palermos (2013; 2016); Palermos and Pritchard (2013; 2016); Bird (2014); Brogaard (2014); de Ridder (2014); Lackey (2014); Carter (2015); Miller (2015) Palermos (2015; 2017); Wagenknecht (2016).

[27] See note 6.

[28] To be fair, de Ridder's argument is more subtle. He claims that a group has knowledge only when *mutually epistemically reliant individuals* are involved in the production of knowledge, that is, when some epistemic materials are irreducibly collective (51). de Ridder puts the point this way,

> Only mutual cognitively necessary epistemic dependence among a group of scientists (or non-scientists) who can be seen as being jointly engaged in a research project generates group knowledge, because only in such cases is it the case that the group (and not any individual on her own) can satisfy (SJ) directly. (51)

In other words, (SJ) is a group property when any epistemic material involved in satisfying (SJ) is a group epistemic material. Goldberg, Miller, and others would likely contend that there are cases of knowledge in which no epistemic material is irreducibly collective, and yet epistemic materials must be distributed in such a way that the normative conditions on knowledge cannot be satisfied by any individual. But this disagreement is inconsequential. de Ridder is concerned with mutual epistemic dependence because he thinks it entails EIK. What matters is that, whichever way EIK is generated, de Ridder takes EIK to entail group knowledge. That is, EIK is group knowledge in virtue of being generated extra-individually. Proponents of epistemic extension reject this move. If epistemic extension is viable, EIK underdetermines group knowledge. Indeed, Hardwig considered cases involving mutual epistemic dependence before identifying epistemic extension as a live option for analysing EIK (1985, 347-8). Proponents of epistemic extension can insist that only what de Ridder labels "derivative" knowledge need be invoked. If scientists are mutually epistemically dependant, each can have "derivative" knowledge; each can have extended knowledge. There is no need to invoke group knowledge in addition to this. Something more than the occurrence of EIK is needed to invoke group knowledge.

[29] Giere (2011) offers a different response to Vaesen (2011a).

[30] Giere is critical of Knorr-Cetina (1999), who seems to argue for the possibility of group knowledge along similar lines to the proponents of the argument from EIK: EIK ought to be ascribed to the set of individuals and artifacts involved in generating knowledge.

[31] In places throughout section 2, I forward the claim that EIK underdetermines group knowledge, so there is no need to invoke group knowledge. I present this as the natural response from proponents of epistemic extension to proponents of the argument from EIK to group knowledge. This response relies on the methodological principle that one ought to invoke a new idea or entity only by necessity, and proponents of epistemic extension claim that EIK does not necessitate invoking group knowledge. So, this response can serve as a reason for favouring option (2) of Hardwig's dilemma in addition to those I offer in section 3.

[32] Furthermore, I argue elsewhere (forthcoming) that group knowledge-how sometimes obtains.

[33] So-called "believers" claim that groups have beliefs, while so-called "rejectionists" claim that groups have acceptances. How exactly we ought to conceive of the relevant group states is immaterial for the purposes of this paper. For more on these issues in relation to group epistemology, see Gilbert (1989; 1994; 2000; 2004); Toumela (1992; 2004); Mathiesen (2006); Wray (2001; 2003; 2007; 2014); Mathiesen (2006; 2011); Staley (2007; 2010); Hakli (2007; 2011); Rolin (2008; 2010); Andersen (2010); Beatty and Moore (2010); Bird (2010; 2014); Bouvier (2010); Baumann (2011); Fagan (2011; 2012); Briggs *et. al.* (2014); Cheon (2014); de Ridder (2014); Gilbert and Pilchman (2014); Tollefsen (2015, chs. 1, 2); Weatherall and Gilbert (2016). On group agency, see List and Pettit (2006; 2011; 2012); Mathiesen (2011); Briggs (2012); Cariani (2012); Pettit (2014); Tollefsen (2015, ch. 3); List (2016). On group personhood, see Kusch (2014); Smith (2018).

[34] Gilbert (1989; 1994; 2000; 2004); Toumela (1992; 2004); Rolin (2008; 2010); Gilbert and Pilchman (2014).

[35] If a proponent of epistemic extension is committed to the traditional tenet that only individuals can possess knowledge, she can analyze all cases of EIK, including all cases of EIK-G, as extended individual knowledge. For such a person, there is no group-level version of Hardwig's dilemma, only special cases of EIK in which option (1) prescribes that knowledge be ascribed to transient groups. I am not offering such an individual any additional reasons to ascribe knowledge to groups.

[36] See https://www.missionjuno.swri.edu/origin for more information on the JunoCam.

[37] In Dragos (2016a; 2016b), I am concerned with the nature of the relationship between research teams and their parent subfields.

[38] I claim that Goldberg's argument is just as compelling when reformulated at the group-level. However, part of what makes Goldberg's argument compelling is the analogy he draws between testimonial knowledge and memorial knowledge. A memorial belief that *p* is a belief that is inferred from (or is otherwise saliently dependent upon) a previously acquired belief that *q*. This is also true of many group beliefs (or acceptances). For example, important coordinated measurements were undertaken in 2015 by the CMS and ATLAS Collaborations. The data are co-published by the collaborations in Aad *et. al.* (2015). This work builds upon important measurements taken independently in 2012 by the CMS and ATLAS Collaborations. The data are published in Chatrchyan *et. al.* (2012) and Aad *et. al.* (2012), respectively. Presumably, the coordinated 2015 results depend on the 2012 independent results, such that were a fundamental problem with the 2012 results, this would negate or undercut the 2015 results. So, I think the memory analogue can be drawn at the group level.

[39] This claim, or the claim that groups face unique epistemic hurdles, is proposed by Briggs *et. al.* (2014); Wray (2014); Lackey (2016); Weatherall and Gilbert (2016). Margaret Gilbert's (2000; 2004) well known joint commitment account of group belief has been both criticized (Wray 2001; Mathiesen 2006; Bouvier 2010) and defended (Beatty and Moore 2010) for making group knowledge, especially group scientific knowledge, more difficult to attain than individual knowledge.

[40] At the same time, I am not aware of any of these philosophers denying the possibility of group knowledge. Fagan (2012, 829) may be an exception. I am sympathetic toward the idea that all EIK is extended individual knowledge, but I cannot say I endorse this claim. Indeed, I argue elsewhere (forthcoming) that group knowledge-how sometimes obtains.

[41] Andersen and Wagenknecht (2013) is another example.

[42] Dragos (2016a; 2016b) are small, exploratory steps into this domain.