

## GROUPS CAN KNOW HOW

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### ABSTRACT

One can know how to ride a bicycle, play the cello, or collect experimental data. But who can know how to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment? Reductionist analyses fail to account for these cases strictly in terms of the individual know-how involved. Nevertheless, it doesn't follow from non-reductionism that groups possess this know-how. One must first show that *epistemic extension* cannot obtain. This is the idea that individuals can possess knowledge even when others possess some of the epistemic materials (e.g. evidence possessed, abilities exercised) generating it. I show that only knowledge-that can be epistemically extended, not knowledge-how. Appeal to epistemic extension is a viable way of avoiding group knowledge-that ascriptions but not group knowledge-how ascriptions. Therefore, groups can know how.

### INTRODUCTION

One can know how to ride a bicycle, play the cello, or collect experimental data. But who can know how to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment? I show that reductionist analyses fail to account for these cases strictly in terms of the individual know-how involved. Nevertheless, it doesn't follow from non-reductionism that groups *possess* this know-how. One must first show that *epistemic extension* cannot obtain. This is the increasingly popular, though controversial, idea in social epistemology that individuals can possess knowledge even when others possess some of epistemic materials (e.g. evidence possessed, abilities exercised) generating it. I show, however, that only knowledge-that can be epistemically extended, not knowledge-how. To possess know-how, one must possess all the epistemic materials generating it. That is, knowledge-how precludes epistemic

extension and entails *epistemic autonomy*. This asymmetry between knowledge-that and knowledge-how is crucial. Appeal to epistemic extension is a viable way of avoiding group knowledge-that ascriptions, but it's not a viable way of avoiding group knowledge-how ascriptions. Therefore, groups can know how.

### KNOWLEDGE-THAT & EPISTEMIC EXTENSION

The CMS and ATLAS collaborations perform high-energy physics experiments centralized at CERN's Large Hadron Collider. Each collaboration has between three and four thousand active members with diverse expertise. Though centralized at CERN's Large Hadron Collider, the collaborations are distributed across nearly two hundred institutes and dozens of countries. In 2012, the CMS and ATLAS collaborations announced that they possessed sufficient evidence to posit the existence of the Higgs boson.<sup>1</sup> Suppose Higgs particles do exist. Knowledge that

Higgs particles exist vividly exemplifies how some knowledge-that can be brought about only by the evidence and cognitive abilities of a group. This is a task far beyond the capabilities of any individual.

John Hardwig (1985) famously argued that often when we want to ascribe knowledge that  $p$  to an individual  $S$ ,  $S$  cannot herself possess all the epistemic materials bringing it about.  $S$  must rely on others. Hardwig argued that, in such cases, either (i)  $S$  knows “vicariously,” that is,  $S$  possesses knowledge without possessing all epistemic materials, or (ii) knowledge is possessed by the group  $G$  of individuals across which epistemic materials are distributed (pp. 348–349). Hardwig opted for (ii): group knowledge obtains in these cases (p. 349).<sup>2</sup>

A growing number of philosophers agree with Hardwig, though for various reasons, that group knowledge-that sometimes obtains.<sup>3</sup> Some of these philosophers follow Hardwig’s reasoning to option (ii): if epistemic materials are distributed, then knowledge is possessed by the group across which they’re distributed.<sup>4</sup> In other words, whenever epistemic materials are not reducible to an individual’s evidence, cognitive abilities, or whatever other epistemic materials are involved in generating knowledge, then knowledge cannot be ascribed to an individual. Unfortunately, option (i) is overlooked. This is a regrettable oversight on the part of Hardwig’s recent adherents given that a growing number of philosophers espouse option (i) by espousing the principle, epistemic extension. This is the idea that individuals can possess knowledge even when others possess some of epistemic materials generating it. So,  $S$  can possess knowledge without possessing all the justifying evidence, or when part of the cognitive process generating  $S$ ’s knowledge is situated outside  $S$ ’s cognitive apparatus, etc. According to epistemic extension, knowledge possession doesn’t entail the possession of all epistemic materials.<sup>5</sup>

Epistemic extension is a controversial idea, so it’s worth unpacking a little. Most epistemologists of testimony take the proper scope of assessment of testimonial belief to range over the relationship of the recipient to the testimonial data. It’s not typically taken to include the original epistemic materials forming the justification-basis for the testifier’s belief or assertion. Sanford Goldberg (2010) departs from the standard model, arguing that assessment of an individual  $S$ ’s testimonial belief that  $p$  must extend beyond the testimonial exchange to the (past) cognitive operations of the testifier that form the justification-basis of the testifier’s belief or assertion that  $p$ . The larger point Goldberg (2010, 2011, 2012) forwards about testimony is that the degree or quality of justification a testimonial exchange itself confers often falls short of knowledge-level. He contends that when the recipient possesses testimonial knowledge, the testifier might possess some of the epistemic generating it.<sup>6</sup>

According to Boaz Miller (2015) often when we want to say an individual  $S$  knows that  $p$ , things could too easily have gone wrong in ways opaque to  $S$  (§V). Miller’s central example is Arthur Eddington’s famous 1919 experiment. Images of the Hyades cluster were taken by two teams during the May 29, 1919 solar eclipse, when the eclipsed sun moved across the cluster. After imposing these on images taken at night, Eddington concluded that the degree to which the Sun’s gravity warped passing starlight confirmed Einstein’s predictions, not Newton’s. However, as Earman and Glymour (1980) show, Eddington discarded seemingly salient data. Suppose this undercuts the justifiedness of Eddington’s conclusions (Collins and Pinch 1993, pp. 43–54; Waller 2002, ch. 3). Consider Hyde, who correctly believes *via* a report of Eddington’s conclusions that general relativity is correct. Compare Hyde with Jekyll, who correctly believes likewise *via* an identical report but

who resides in a close possible world in which Eddington reported all data and justifiably arrived at the same conclusion. Miller's point is that it is often opaque to the recipient of testimony whether she's in a Hyde-like or Jekyll-like scenario.<sup>7</sup> Rather than allow the possibility of Hyde-like scenarios to undercut Jekyll-like ones, Miller argues that:

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. (p. 419)

That is, sometimes *S* knows that *p* when *S* doesn't possess all the epistemic material generating it. So, Miller straightforwardly endorses epistemic extension.<sup>8</sup>

The above arguments for epistemic extension are in large part negative: reasons for extending the scope of assessment over epistemic materials not attributable to the knowledge bearer. But several epistemologists of cognitive externalism offer one type of robust, positive account that entails epistemic extension. Most of these epistemologists are concerned with extended cognition, according to which cognition can extend 'outside the head', over artifacts, environmental features, and other subjects. While most epistemologists of extended cognition don't directly endorse epistemic extension, their analyses of certain cases of knowledge *via* extended cognition entail epistemic extension.<sup>9</sup> When *S* knows that *p* through extending her cognition over the cognitive efforts of others, some epistemic materials cannot be ascribed to *S*. Some are the cognitive contributions of other agents. Thus, for any knowledge obtained by extending cognition over the cognitive efforts of others, epistemic extension obtains: an individual can possess knowledge even when the cognitive abilities of that individual are

only some of the epistemic materials generating knowledge. Like Goldberg, Miller, and a growing number of others, these philosophers endorse epistemic extension.<sup>10</sup>

When the goods bringing about knowledge are distributed across multiple individuals, we can avoid ascribing knowledge-that to groups by taking option (i) of Hardwig's dilemma seriously. If epistemic extension is a viable principle, it's possible for an individual to possess knowledge-that without possessing all the epistemic materials bringing it about.

### KNOWLEDGE-HOW & EPISTEMIC EXTENSION

Can we make the same move in analogous cases of knowledge-how, such as knowing how to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment? When the epistemic materials bringing about know-how are distributed, can we appeal to epistemic extension to avoid group knowledge-how ascriptions? In this section, I show that appeal to epistemic extension is viable only in cases of knowledge-that, not knowledge-how. Possessing knowledge-how means possessing all the epistemic materials generating it. That is, knowledge-how precludes epistemic extension and entails epistemic autonomy. The two kinds of knowledge are asymmetrical in this respect. Thus, if any subject knows how to  $\phi$  when epistemic materials are distributed, it's a group. It's the tandem cycling pair that knows how to properly ride a tandem bicycle, the orchestra that knows how to perform a symphony, and the high-energy physics collaboration that knows how to run a high-energy physics experiment.

### REDUCTIONISM

I've set up a dilemma between individual know-how *via* epistemic extension and group know-how due to epistemic autonomy. But there's a dilemma only if these are genuine cases of know-how—cases not reducible to the individual know-how involved. According

to *eliminative reductionism*, there's no group know-how, only the individual know-how involved. These reductionists *eliminate* group know-how by appeal to the individual know-how involved. According to *summative reductionism*, there's "group" know-how but only in a shallow sense. These reductionists *identify* group know-how with the sum of individual know-how involved (Palermos and Tollefsen, 2018, p. 7). By "group know-how," I mean a group knows *qua* group how to  $\phi$ . Both types of reductionist oppose this idea.<sup>11</sup>

It seems counterintuitive that no one knows how to ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. We praise or blame groups, not just the individuals involved (Palermos and Tollefsen, p. 6). We give car-of-the-year awards to car companies and Nobel prizes to research teams. We hold some musical groups in higher esteem than others. We say, "the Montreal Canadiens's front office has done a poor job of constructing a hockey team." We hold groups *responsible*. So, eliminative reductionism is at least counterintuitive. Perhaps summative reductionism satisfies this intuition. But there can be frequent turnover in groups (Palermos and Tollefsen, p. 7). Members of research teams, experimental collaborations, orchestras, and hockey front offices retire or move on, as do vehicle assembly line workers. So, it seems some group know-how can't be identified with the know-how of the *specific individuals* constituting the group. Perhaps such know-how is instead constituted by the know-how of non-specific individuals in *specific positions*. But if any position is vacant for any time, it seems the reductionist must say that the group temporarily doesn't know how to  $\phi$ . We don't conceive of know-how as occurrent. I know-how to ride a bicycle when I'm sleeping (Palermos and Tollefsen, p. 8). A car company doesn't lose its knowledge of how to make a certain model of vehicle just because it has yet to hire a replacement for Bob, the retired assembly

line worker. Furthermore, some competent groups don't have fixed positions. Experimental collaborations and hockey management teams frequently change in size. Some include sub-departments (e.g., analytics) and positions (e.g., sports psychologist) that others don't.

Reductionism has the most difficulty with group competences generated through coordination, integration, and reciprocation, and not through simply combining discrete, isolated, individual competences. Palermos and Tollefsen describe these sorts of groups:

When individual members *coordinate* on the basis of reciprocal interactions, they adapt mutually to each other by *restricting* their actions in such a way so as to *reliably*—that is, regularly—achieve ends that they would only luckily—if ever—bring about were they to act on their own. Via the application of such positive mutual constraints, which result from, and further guide, the members' coordinated activity, new collective properties (i.e., regular behaviors) emerge and the collective achieves a stable configuration that is necessary for its successful operation. (pp. 17–18)

Part of me knowing how to ride a bicycle is me knowing how to adjust my body reactively to the way the bicycle's weight is distributed. The input I react to changes constantly, and so too do my outputs. When I press the right-peddle, I shift my body leftward as a counterbalance. When I ride down a steep hill, I don't lean forward because I don't want to flip forward over the handle-bars. When I ride a tandem bicycle, these tasks are distributed between me and another agent. Crucially, each of our outputs are parts of each of our dynamic environments, such that *overall balance* is achieved in tandem. Our stable, regular, reliable performance is grounded in integrated, coordinated, and reciprocal action. It's not merely the sum of isolated competences. After an afternoon's practice, a pair can come to know how to properly ride a tandem bicycle. But things are far

more complex when it comes to performing a symphony or running a high-energy physics experiment.<sup>12</sup>

So, in some cases of know-how, some epistemic materials are not only distributed across multiple individuals or positions, they're irreducibly grounded in integration, collaboration, and/or reciprocation. Some group know-how can't be eliminated by appeal to the individual know-how involved, nor can it be identified with the sum of individual know-how involved. However, the failure of reductionism doesn't imply that these must be cases of group know-how. There's a third possibility: these are cases of epistemically extended, individual know-how. In the remainder of this section, I show that knowledge-how precludes epistemic extension and entails epistemic autonomy. Possessing know-how means possessing all the epistemic materials generating it. Thus, no individual can know how to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. Epistemic autonomy demands that the knowledge-bearing subject bears all epistemic materials: the tandem cycling pair, the orchestra, and the high-energy physics collaboration. I show this to be the case regardless of which model of knowledge-know is correct.

#### ANTI-INTELLECTUALISM

Anti-intellectualism, which is commonly ascribed to Gilbert Ryle (1949), is the view according to which knowledge-how and knowledge-that are different in kind. That is, having know-how doesn't reduce to having knowledge-that. There are two types of anti-intellectualism. According to the *ability account*, knowing how to  $\phi$  consists in having the ability to  $\phi$ . It's clear that neither tandem cyclist *can* alone properly ride a tandem bicycle, that no orchestra member *can* alone perform a symphony, and that no experimenter *can* alone run a high-energy physics experiment. If an individual cannot

possibly  $\phi$ , then that individual cannot  $\phi$  with knowledge-level competence. Thus, no individual can possess the *ability* to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. Only the pair of tandem cyclists, the orchestra, and the high-energy physics collaboration can. So, only these groups can possibly have the requisite abilities.

When analyzing knowledge-that, one can distinguish between a belief and the belief-generating process that, together with truth, confers the status of knowledge on that belief. To have epistemically extended knowledge-that is to have the former without having all the latter. On the ability account, knowledge-how consists in ability. One can't split the concept of ability into a terminal state (i.e., the ability) and good-makers (i.e., the "ability-grounding materials"), such that one can possess the former without possessing all the latter. I can't know-how to  $\phi$  in virtue of another's ability to  $\phi$ . On the ability account, know-how consists in ability. So, on the ability account, no epistemic materials (i.e., the relevant abilities) can be possessed by a subject other than the subject who possesses know-how. This prohibits epistemic extension and entails epistemic autonomy. Only a group can possess the ability to a properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. Therefore, on to ability account, only a group can know how to do these things.

The ability account has been met with counter-examples. Stanley and Williamson (2001, p. 416) claim that a pianist who has lost her arms still knows how to play the piano, though she no longer has the ability to play the piano.<sup>13</sup> If this is right, then knowing how to  $\phi$  isn't just having the ability to  $\phi$ . The alternate version of anti-intellectualism is the "disposition account," according to which knowing how to  $\phi$  involves being disposed to  $\phi$  in the relevant circumstances. On this account, the pianist knows how to play the piano

because she retains the necessary dispositions even after losing her ability. But note that having had the relevant ability *at some point* remains necessary. The requisite dispositions must have originated in connection with the relevant abilities. Thus, I need only slightly modify my argument. On the disposition account, to know how to  $\phi$  one must have the disposition to  $\phi$ , and to have the disposition to  $\phi$ , one must have, or have once had, the ability to  $\phi$ . So, on both the ability and disposition accounts, to know how to  $\phi$  is to have, or have once had, the ability to  $\phi$ . No individual could ever have possessed the ability to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. Thus, no individual could ever have developed the requisite dispositions. Only groups can have the requisite dispositions and have, or have once had, the requisite abilities. Thus, only a group can know how to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment.

On either the ability or disposition accounts no epistemic materials (i.e., abilities, dispositions) can be possessed by a subject other than the subject possessing know-how. Both accounts prohibit epistemically extended know-how. Thus, for cases of know-how in which epistemic materials can be possessed only by a group, know-how can be possessed only by that group.

#### INTELLECTUALISM

According to intellectualism, know-how reduces to having the relevant knowledge-that, such that all know-how can be analyzed in terms of knowledge-that. On Stanley and Williamson's (2001) influential account, subject  $N$  knows how to  $\phi$  only if  $N$  knows that there's a contextually relevant way  $W$  for  $N$  to  $\phi$ . But there's no conceivable way  $W$  for an individual  $S$  to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. Thus,  $S$  cannot *know* that there's a contextually relevant way  $W$  for  $S$

to do any of these things. There's a contextually relevant way  $W$  only for a group to ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. For  $N$  to possess know-how is for  $N$  to possess knowledge-that there's a contextually relevant way  $W$  for  $N$  to  $\phi$ . That these don't come apart means epistemic extension is ruled out. Therefore, that  $N$  is sometimes a group means groups can know how.

Suppose we formulate the modal condition permissively. Suppose I know how to craft a great dry-hopped sour beer because I can apply what I know about crafting other types of beer. A less permissive account might permit me to know how to craft a great dry-hopped sour beer only after some application and experimentation. But no reasonable degree of permissiveness can afford a single tandem cyclist, orchestra player, or experimenter a way  $W$  to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. In these cases, even a loose modal condition doesn't grant an individual  $S$  knowledge that there's a contextually relevant way  $W$  for  $S$  to  $\phi$ . There's no  $W$ .

There's a good amount of literature concerned with whether know-how can be grounded in non-verbal, demonstrative, indexical, first-personal, contextual, tacit, or other forms of knowledge-that-relations to propositions. But  $S$  can have none of these forms of knowledge about a way  $W$  for  $S$  to  $\phi$  when  $S$  cannot  $\phi$ . On none of these characterizations of the relevant knowledge-that can  $S$  have knowledge-that there is a conceivable way  $W$  for  $S$  to alone properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. There are also intellectualist-style alternatives grounding know-how in an epistemic relation to a proposition beside the knowledge-relation (e.g., justified true belief, understanding). But on none of these characterizations of the relevant epistemic relation can  $S$  have the necessary relation to a conceivable way  $W$

for  $S$  to alone properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment. There's no  $W$  to which  $S$  can stand in relation.<sup>14</sup>

The idea that knowledge-that can be epistemically extended is viable, and intellectualism does ground knowledge-how in knowledge-that. So, intellectualism seems to be our best shot of avoiding group knowledge-how ascriptions. But in some cases of know-how, there's no way  $W$  that an individual  $S$  can  $\phi$ . So, there's no way  $S$  can *know* that there's a contextually relevant way for  $S$  to  $\phi$ . Thus, there's no way for one subject to possess know-how while relying on another subject to satisfy a condition on know-how. Epistemically extended know-how is ruled out. Since ways to properly ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment are afforded only to groups, only groups can possibly know-that there's a contextually relevant way  $W$  for a group to ride a tandem bicycle, perform a symphony, or run a high-energy physics experiment.

Recall that the argument from anti-intellectualism to group know-how requires the notion of group ability. Only a group is, or once was, able to properly ride a tandem bicycle, perform a symphony, or run

a high-energy physics experiment. Notice that the argument from intellectualism to group know-how requires invoking group knowledge-that! If a group  $G$  knows how to  $\phi$ ,  $G$  knows that there's a way  $W$  for  $G$  to  $\phi$ . No individual can possess all of the knowledge-that about the way  $W$  that the CMS and ATLAS experiments are run.

#### CONCLUSION

In this paper, I analyzed cases of knowledge-how in which the epistemic materials generating it are possessed by a group. I showed that reductionist analyses fail to account for these cases strictly in terms of the individual know-how involved. Yet, this doesn't imply that know-how must be attributed to groups. Perhaps these are instead cases of epistemically extended, individual know-how. However, I showed only knowledge-that can be epistemically extended, not knowledge-how. This is the case regardless of whether intellectualism or anti-intellectualism about knowledge-how is correct. If such know-how can't be reduced to individual know-how, and if it can't be epistemically extended individual know-how, it must be group know-how. I've shown that groups can know how.

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#### NOTES

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1. For the original CMS and ATLAS results, see Chatrchyan, Khachatryan, Sirunyan, *et. al.* (2012) and Aad, Abajyan, Abbott, *et. al.* (2012), respectively. See also Aad, Anderson, Apresyan, *et. al.* (2015), which reports coordinated CMS and ATLAS measurements. Evidence for the existence of Higgs particles was generated independently by CMS and ATLAS, then in collaboration. Note also that each paper has thousands of authors.
2. Hardwig spells out this dilemma in evidentialist terms. I've generalized it.
3. For example, 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

(2011); Dewitt (2012); Palermos and Pritchard (2013, 2016); Bird (2014); de Ridder (2014); Lackey (2014); Carter (2015); Palermos (2015, 2017); Wagenknecht (2016).

4. For example, Hardwig (1985); Knorr-Cetina (1999); Vaesen (2011); Bird (2014); de Ridder (2014). See Dragos (2016a, 2016b, manuscript) for arguments concerning this move.

5. Proponents of epistemic extension or of an account entailing it include Thagard (1997, 2010); Giere (2002, 2006, 2007, 2011, 2012); Goldberg (2010, 2011, 2012); Green (2012, 2013, 2014); Shieber (2013); Palermos (2016); Kelp (2013, 2014); Brogaard (2014); Miller (2015). “Epistemic extension” is derived from Goldberg’s (2010) “epistemic extendedness.” For simplicity, I speak only of knowledge. But what I say applies, *mutatis mutandis*, to other standings, such as justified true belief.

6. For related arguments concerning the less-than-knowledge-level standing of testimonial justification, see Joseph Shieber (2013), who like Goldberg (2010) defends a process reliabilist account predicated on epistemic extension. In closing, Shieber proposes “that the notion of process be broadened to include genuinely social belief-forming processes” (p. 290). See also Green (2013), de Ridder (2014, pp. 47–48), and especially Miller (2015, pp. 421–422), who rightly shows that Hardwig (1985) was concerned with “knowledge-level justification,” and not with the often lesser epistemic standing conferred directly by testimony.

7. Miller also employs data showing that Hyde-like scenarios are common even in science (pp. 426–427). For example, according to an anonymous survey of 3200 scientists published in *Nature* (Martinson, Anderson, de Vries, *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”; 15.5% admit to “changing the design, methodology or results of a study in response to pressure from a funding source.”

8. Epistemic extension is not implied by externalism, though it’s an extended externalist principle. Externalists maintain that epistemic materials can include external states, but most externalists maintain that these states are possessed by the knowledge-bearing subject *S*. Proponents of epistemic extension maintain that some external epistemic materials might not be possessed by *S*. Thus, unlike most externalist views, epistemic extension allows for knowledge possession without the possession of all epistemic materials. Had social epistemic materials been taken seriously early in the externalist turn, early externalist models would have come with epistemic extension built in. But most externalists have abandoned such models. They take the scope of epistemological assessment to range over the individual subject’s cognitive system only. In the relevant respects, agent reliabilism is process reliabilism according to which epistemic materials are possessed only by the knowledge bearer. Causal theories are likewise restricted. For example, according to Alston (1995, pp. 11–12, 15–16), all salient causes are “proximate,” that is, part of the individual subject’s cognitive apparatus. For contextual models, local environmental factors are not epistemic materials. Rather, epistemic materials are factors subject to contextual analysis. In reliabilist terms, epistemic materials are determinants of global, not local, reliability.

9. Green (2012, 2014) is an exception. He appeals directly to Goldberg (2010) to formulate an extended credit theory of knowledge.

10. Kelp (2013, 2014), Brogaard (2014, pp. 57–60), and Palermos (2016) also offer analyses of cases in which individuals acquire knowledge when extending their cognition over the cognitive efforts of others. In these cases, the knowledge bearer does not bear all epistemic materials. Thus, epistemic extension obtains. Both Ronald Giere (2002, 2006, 2007, 2011, 2012) and Paul Thagard (1997, 2010) insist that knowledge be ascribed to individuals even when cognitive labour is distributed across com-



plex systems of people and artifacts. They also endorse epistemic extension, but they're interested in distributed cognition, not extended cognition.

11. Palermos and Tollefsen (2018) and Kallestrup (forthcoming) are the only others I am aware of who address the notion of group know-how. I thank an anonymous referee for directing me to Palermos and Tollefsen's paper. I rely on Palermos and Tollefsen's rejection of reductionism in this subsection. The reader can consult Palermos and Tollefsen's paper about how my argument can be spelled out in both intellectualist and anti-intellectualist terms. To avoid unnecessary repetition, I offer a briefer, generalized argument. The remainder of my paper differs from Palermos and Tollefsen's in two significant ways. First, I rely on an asymmetry between knowledge-that and knowledge-how: only the former can be epistemically extended. Palermos and Tollefsen consider only reductionism, not epistemic extension. The possibility of epistemically extended know-how would undercut Palermos and Tollefsen's proposal. I rule it out. So, my argument buttresses theirs. Second, I don't offer a particular model of group know-how. Palermos and Tollefsen focus on generating intellectualist and anti-intellectualist models of group know-how, then combining them into a hybrid model. They're concerned with characterizing group know-how. I'm concerned with showing that groups can know how by ruling out *all* the alternatives for certain cases. Like Miller's (2015) argument concerning knowledge-that, my argument concerning know-how is largely negative. But I hope my paper motivates more work about the specific character of group know-how.

12. In common sports parlance, it's often said that a particular group of athletes "have chemistry," "gel," "are on the same wavelength," or "read each other" in ways that can't be explained or predicted strictly by appeal to the statistics and analytics of individual athletes.

13. There are several analogues to Stanley and Williamson's pianist in the literature (e.g., Ginet 1975, p. 8; Snowdon 2003, p. 8).

14. Also, I can't know how to  $\phi$  solely in virtue of knowing a way for *another* to  $\phi$ . I can know how to  $\phi$  in virtue of knowing a way for *me* to  $\phi$ . Even if I come to know a way for *me* to  $\phi$  by applying my knowledge of a way for *another* to  $\phi$  to myself, I ultimately know how to  $\phi$  in virtue of knowing a way for *me* to  $\phi$ .

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