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GROUP KNOW-HOW

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Abstract. While mainstream epistemology has recently turned its focus on individual know-how (e.g., knowing-how to swim, ride a bike, play chess, etc.), there is very little, if any, work on group know-how (e.g., sports-team performance, jazz improvisation, knowing-how to tango, etc.). This chapter attempts to fill the gap in the existing literature by exploring the relevant philosophical terrain. We start by surveying some of the recent debates on individual knowledge-how and we argue that group know-how (G-KH) cannot always be reduced to individual knowledge-how. Rather, certain cases of G-KH call for a non-reductive analysis. A natural place to look for a theory of irreducible G-KH is the literature on joint intentionality and distributed cognition. First, we explore what a joint intentionality approach to G-KH might look like. Then we consider an alternative approach that views G-KH as a form of distributed cognition. Finally, we discuss a potential link between the two approaches.

Introduction

Human beings know-how to do things and often exhibit skill in performing tasks. They ride bikes, play musical instruments, drive cars, solve math problems, and speak languages, among many other things. These are examples of know-how. But human beings do not always act alone. They often do things with others. A scientific research team performs experiments, sports teams execute plays, an orchestra plays a piece of music, professional dancers dance the tango. In these cases, we seem to have instances of group know-how (G-KH). Indeed, in cases where knowledge-how is highly distributed (as in the case of an

orchestra whose members know-how to play their own instrument but not each others') it would seem that the bearer of know-how is the group rather than any particular individual.[1] Although there has been a great deal of work done on individual know-how (e.g., Bengson and Moffet 2007, 2011a, b; Stanley 2011a, b; Stanley and Williamson 2001; Carter and Pricthard forthcoming; Brogaard 2011; Poston 2009; Ryle 1946, 1949) there has been very little, if any, work on group know-how.[2]

A natural place to look for a theory of G-KH is the literature on joint intentionality (Gilbert, 2007a, 2007b, 2007c, 2010; Tuomela 1992, 2004; Tollefsen 2015; Wray 2001) and distributed cognition (e.g., Barnier et al., 2008; Heylighen et al., 2004; Hutchins, 1996; Sutton et al., 2010; Sutton, 2008; Theiner et al., 2010; Theiner, 2013a, 2013b; Theiner & O' Connor, 2011; Tollefsen & Dale, 2012; Tollefsen, 2006; Wilson, 2005). Both contain theories of group know-that and arguments for the irreducibility of group propositional knowledge to individual knowledge and/or epistemic abilities. This literature, however, has focused entirely on propositional knowledge, without providing any theory of G-KH. This paper aims to fill this lacuna.

The paper is organized in the following manner. In section I we survey some of the recent debates regarding individual knowledge-how. In section II, we argue that G-KH isn't plausibly reduced to individual knowledge-how. In section III, we explore what a joint intentionality approach to G-KH might look like and what might be the shortcomings of such an approach. In section IV, we consider an alternative approach that views G-KH as a form of distributed cognition. In section V, we discuss a potential link between the two suggested approaches.

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[1] One might worry that in the case of the orchestra, the conductor's accentuated role suggests that she is the one who knows-how to perform, say, Mozart's Symphony No 36. Yet we are doubtful that such cases of differential authority indicate that the group's know-how can be reduced to the know-how of the corresponding 'conductor'. In the case of the orchestra, for example, the conductor still doesn't know how to perform the part of every musician involved. Given the size of the group, her role is more likely one of a general coordinator. If still in doubt, one may consider smaller musical ensembles where no conductor is required.

[2] Though note that Carter and Czarnecki (2016) have recently turned their focus on the possibility of extended know-how—i.e., know-how, that, even though it is not distributed between several individuals at the same time, it is distributed between an agent and her artefact.

I. Recent Debates about Know-How

Intellectualism is the view that know-how is a species of knowledge-that (Stanley 2011a,b; Stanley and Williamson 2001).[3] Anti-intellectualism is the denial of intellectualism and holds that knowing-how to $\varphi$is in virtue of the possession of some relevant ability or disposition to φ. Gilbert Ryle offers an anti-intellectualist position in *The Concept of Mind* (1949).[4] According to Ryle, knowing-how to ride a bike, for instance, should be understood as a set of dispositions to behave in certain ways under certain circumstances. One could have all the propositional knowledge in the world concerning bike riding but if one lacks the ability to ride a bike one does not know-how to ride a bike. Stanley and Williamson (2001), on the contrary, have recently argued that know-how is a form of knowledge-that. According to Stanley and Williamson (*ibid*), when someone knows-how to ride a bike they know that a way, W, is the way to ride the bike. They don't deny that knowledge-how involves ability but they insist that know-how can be reduced to propositional knowledge. Anti-intellectualism denies this claim. Intelligent behavior may involve know-that but it is a form of ability or disposition on the part of the agent to perform successfully, not to be analyzed in terms of know-that.

But, if intelligence is not a matter of possessing some relevant propositional knowledge, then what might be the difference between mere successful performance like the automatic operation of a well-functioning instrument and the manifestation of genuine intelligent skill? Ryle suggests focusing on the notion of responsibility:

> What is involved in our descriptions of people as knowing how to make

[3] This is the standard way of characterising intellectualism. Bengson & Moffett (2011a*),* however, have recently suggested that this definition conflates the questions of (a) what may ground know-how and (b) what is the nature of know-how. As they suggest, it is possible to be an intellectualist without being a propositionalist. Accordingly, they put forward *objectualist* intellectualism, according to which "to know how to act is to understand a way of so acting, where such objectual understanding involves grasping (a possibly implicit) conception that is poised to guide the successful, intentional performance of such an act— hence, to possess a cognitive state with a distinctively practical character." (Bengson & Moffett 2011, 161). While this is an interesting attempt to reconcile intellectualism and anti-intellectualism, we will here focus on the classical approaches to the debate.

[4] See also Ryle (1946).

> and appreciate jokes, to talk grammatically, to play chess, to fish, or to argue? Part of what is meant is that, when they perform these operations, they tend to perform them well, i.e. correctly or efficiently or successfully. Their performances come up to certain standards, or satisfy certain criteria. But this is not enough. The well-regulated clock keeps good time and the well-drilled circus seal performs its tricks flawlessly, yet we do not call them 'intelligent'. We reserve this title for the persons responsible for their performances. To be intelligent is not merely to satisfy criteria, but to apply them; to regulate one's actions and not merely to be well-regulated. A person's performance is described as careful or skillful, if in his operations he is ready to detect and correct lapses, to repeat and improve upon successes, to profit from the examples of others and so forth. He applies criteria in performing critically, that is, in trying to get things right. (Ryle 1949, 29)

According to Ryle then mere successful performances differ from intelligent performances in that the latter, but not the former, exhibit some form of responsibility that allows the relevant agents to take ownership of their successful performances.

The above distinction between intellectualism and anti-intellectualism can be used in order to explore two alternative ways in which G-KH might be said to be irreducible to the skills of the group members. By combining intellectualism with the joint intentionality approach, it is possible to put forward the following claim: There is propositional knowledge of some way, W, that allows the manifestation of successful performance P, but the propositional knowledge of W cannot be reduced to the knowledge of individuals within the group—instead, it is known by the group as a whole. Alternatively, we can combine anti-intellectualism with the hypothesis of distributed cognition in order to argue that responsibility for the successful performance of certain abilities/dispositions can only be attributed to groups of people as wholes. In such cases, the successful performance of the group is not regulated by the aggregate abilities of the members of the group, but by the synergetic operation of the group as a whole.

Before engaging with these two approaches to irreducible G-KH, we must first say a few things about why we believe that the know-how of groups cannot always be understood by reducing it to the know-how of the individual members of the group.

II. Reducing G-KH

Consider a putative case of G-KH. The New York Philharmonic performs Mozart's Symphony No. 36. This performance occurs often and with great success. Although the various musicians are credited with performing well, the New York Philharmonic is praised for its performance of the symphony. One might argue, however, that our attributions of G-KH to the NY Philharmonic are simply short hand ways of referring to the know-how of individual musicians and G-KH is simply a function of individual know-how added together. We can represent this approach in the following way:

A(KH)+B(KH)+C(KH)...=G-KH,
where A, B, C... are the individual members of the philharmonic.

This approach seems to have the most traction in cases where the contributions of each individual within the group are made in an additive rather than an integrative way. Consider the work of a production line. Corvettes are made via a highly distributed process. The various parts of the Corvette are added as it moves through the production line. Employees make contributions to the car one after the other. When one part or system is installed the car moves to the next station and the process continues through review and testing until the product is a car ready for the sale. Each person on the production line has his or her own domain of expertise. The welder knows-how to weld the frame of the car, the mechanic knows-how to build the engine, the painter knows-how to paint the car and so on. All of this know-how constitutes knowing-how to make a Corvette.

A reductionist approach like this might further reduce the individual know how to knowledge that, combining intellectualism and reductionism. Each individual in the company might have propositional knowledge of a way, W, that W is the way to do his part. Or the reductionist might rest content with reducing G-KH to individual KH where that is understood in terms of an ability of the individual member to perform some action

that contributes to the larger joint action. Regardless of how one understands individual know-how we think there are problems with the reductive approach.

First, on this account no one knows-how to make a Corvette. Each individual in the company knows their own domain but no one person knows-how to do all the various things that comprise making the Corvette. And this is so even if one reduces individual know-how to individual propositional knowledge. Each individual knows of a way, W, that W is the way to *do φ where φ* is her job. But no one individual, we can imagine, knows of a way, W that is the way to make a Corvette because no one individual has all the relevant expertise required in order to build a Corvette. Corvettes are made but apparently no one knows-how to make them.

This is counterintuitive and it certainly clashes with our practice of praising and blaming Corvette for its cars. The company routinely wins awards for its cars. The credit is given to the company. But on this approach no one should be given credit because no one knows-how to make a Corvette.

Perhaps the production manager has some knowledge of the overall process of making a Corvette and so it is the production manager that knows-how to make a Corvette? No doubt the production manager has toured the factory and knows what happens at each stage of the process. He probably knows technical information about the engine as well but it is highly unlikely that the production manager could make a Corvette himself. It is a bit counterintuitive, then, to say that he knows-how to make a Corvette if he couldn't actually make one himself or teach someone to make one.

Perhaps the original designer, Harly J. Earl, knew-how to make a Corvette and that know-how is simply embodied in the design of the production line? The only one who really knows-how to make a Corvette then is Mr. Earl? But Mr. Earl didn't make the Corvette himself. He passed his design off to Robert F. Mclean and various other people who combined their expertise to produce the first proto-type. Again, if we attempt to reduce G-KH to the know-how of individuals (construed along either intellectualist or anti-

intellectualist lines) we end up having to say that no one knows-how to do what the group does. A very counterintuitive result given that we give credit to groups for knowing-how to perform certain actions and for completing those actions skillfully.

The above suggests that trying to reduce G-KH to the sum of individual know-how leads to the absurd conclusion that no one knows. But one might argue that an additive view can be reductionist without being eliminativist. The additive approach *identifies* group know-how with the totality of individual know-how of group members. Just as an identity theorist who identifies mental states with brain states need not be committed to elimination of mental states, the additive view need not be committed to the view that no one knows-how to make a Corvette. Knowing-how to make a Corvette simply is the sum of all workers' individual know-how to build and put the relevant parts together.

But what sort of identity theory might the additive view be offering? Recall our formulation:

A (KH) + B(KH) + C (KH).....= G(KH)

Is the suggestion that G-KH is *identical* to the sum of individual know-how where this is the know-how that *specific* individuals have during a specific time? Corvette's knowing-how to build a Corvette right now is to be identified with Arron the Welder's know-how, Bob the designer's know-how, Catherine the mechanic's know-how? This seems problematic. Corvette's employees change over time. If Corvette's know-how is identified with a specific set of individual's know-how then when Catherine takes a job at Honda, Corvette no longer knows-how to make its cars. We must understand the additive account in the following way, then:

p(KH) + q(KH) + r(KH).....=G(KH),

where p, q, r... represent *some* individual rather than any specific individual.

Corvette knows-how to make a car whenever there is some person in the various positions that knows-how to do their job. But this doesn't seem to work either. Know-how is, according to both intellectualist and anti-intellectualist, a standing state not an occurent one. We know-how to ride a bike even when we are sleeping. Likewise, it seems like Corvette knows-how to make a car even when an employee, whose job is to do φ leaves the company and the position remains open. Perhaps such a loss makes it impossible for them to make cars that week until they find a replacement. Breaking a leg might prevent one from riding a bike. But surely we would want to say that Corvette still knows-how to make its famous cars, just as we would want to say that someone with a broken leg still knows-how to ride a bike. We are therefore disinclined to think that an identity theory of group know-how will work either. On the additive approach, knowing-how to build a Corvette cannot be identified with the aggregate know-how of the members of the group—at least not the know-how of any specific individuals. But then, if it is not the aggregate of any specific individuals that knows-how to build a Corvette, who could possibly be said to know-how to build a Corvette on the additive view?

Second, even if there is a way out of this problem such that the reductive approach can retain its plausibility when applied to cases where the labor contributed by individual members is done in an isolated and consecutive manner, as perhaps in the case of building a Corvette, it is less plausible in a case where individual members are in continuous interaction with other members and need to be so in order to carry out the action. Consider, for instance, the skilled performance of an athletic team. The "draw" is a play in American football made famous by the Cleveland Browns. It involves tricking the defensive line in to opening up a gap by drawing them toward the quarterback who is feigning a pass. In a standard "draw" the following things need to happen:

-The quarterback drops back to pass, just long enough to get the pass rush to come forward

-The offensive line momentarily show a pass block in order to further induce in the defensive line the belief that the quarterback is going to pass but they also try to push the defenders to the outside, creating a gap in the middle of the defensive line.

-The running back momentarily fakes as if he is going to help pass protect and then takes the hand-off from the quarterback and heads downfield through the gap in the middle of the defensive line.

-The receivers run "clear-out" routes downfield as if they are preparing for a pass and in order to draw the defensive backs out of play.

Players on offense need to know-how to do each of their particular jobs but each of those jobs requires an ongoing interaction with others in the team. The play is not a result of adding up discrete individual actions or individual know-how regarding those actions, as the Corvette case might be. Rather, the play itself is constituted by the complex interactions of individuals on the team. The performance of a symphony is similar in this respect. I may perform my musical instrument very skillfully but the skilled performance of the New York Philharmonic requires more than my skillful contribution. My contribution needs to be integrated with others' contributions in a way that produces a collective skilled performance. This type of performance seems to emerge from the complex interactions of individual members, rendering G-KH irreducibly collective.

In fact, a growing body of research within cognitive science appears to attest to the possibility of irreducible G-KH. Sports-team performance and rhythmic coordination are taken to be paradigmatic cases of emergent collective behavior.[5] Cooke et al. (2013, 256) note, for example, that

> The term "cognition" used in the team context refers to cognitive processes or activities that occur at a team level. Like the cognitive processes of individuals, the cognitive processes of teams include learning, planning, reasoning, decision making, problem solving, remembering, designing, and assessing situations [...]. Teams are cognitive (dynamical) systems in which cognition emerges through interactions.

[5] See, for examples, Schmidt, Bienvenu, Fitzpatrick & Richardson, 1998; Riley, Richardson, Shockley & Ramenzoni, 2011; Duarte, Arraújo, Correia & Davids, 2012; Coey, Varlet & Richardson, 2012; Schmidt and Richardson, 2012; Duarte et al., 2013*a*; Duarte et al., 2013*b*; Dale, Fusaroli, Duran & Richardson, 2014; Richardson, Dale and March, 2014, Marsh, Richardson and Schmidt, 2009; Cooke, Gorman, Myers & Duran, 2013

Moreover, while sports-team performance may easily qualify as a form of collective skillful behavior, suitable for qualifying as G-KH, some authors go even further by studying considerably more intelligent performances. A number of cognitive scientists, for example, study interpersonal communication and dialogue within groups not as the serial exchange of individual-level skills but as a form of collective intelligent behavior that emerges on the basis of the interlocutors' synergetic coordination and interactions (Fusaroli, Gangopadhyay, Tylén, 2014; Fusaroli, Raczaszek-Leonardi and Tylén, 2013; Fusaroli and Tylén, 2013; Fusaroli and Tylén, 2015; Tylén, Riccardo, Bundgaard & Østergaard 2013).

III. An intellectualist approach to G-KH

If G-KH can't be reduced to the summation of individual know-how in a group then we need to acknowledge that groups, themselves, are the bearers of G-KH. In the remainder, we aim to develop two possible ways in which this may be accomplished, starting, in this section, with an intellectualist approach that draws on accounts of joint intentionality and action.

There are a variety of theories of joint intentionality on offer and we don't have space here to explore all of these accounts and how they might be extended to make sense of G-KH. Instead we will focus on one plausible account of group knowledge and see how that might serve as the basis for an intellectualist account of G-KH.

According to the collective acceptance view of group belief (Tuomela 1992, Wray 2001), a group believes that p if all or most of the relevant members accept that p as the view of the group and such acceptance is common knowledge among the members of the group. Group knowledge is then a function, in part, of group beliefs being *justified*. According to Tuomela, this involves the members having reasons for accepting p as the view of the group (Tuomela 2004). According to Schmidt (1994), Tollefsen (2002), and more recently Goldman (2014), the justification of group belief should be understood

along reliabilist lines. A group belief is justified insofar as it is produced by a reliable process.[6]

Now consider again the symphony that performs a piece of music with skill and expertise. Could G-KH in this case be a function of the members' joint acceptance of a proposition? Perhaps the group members accept a way, W, that is the way to perform Mozart's Symphony No 36, and that W is the way *that* φ(i.e., playing Mozart's Symphony No 36) is done? Group propositional knowledge of W and G-KH would then reduce to the individual members' joint acceptance of W as the way *that* $\varphi$is done. Each member might jointly accept that W is the way without personally knowing or believing that W is the way, because, for instance in the case of the orchestra, doing so would go beyond their individual members' cognitive capacities. Members only know-how to perform their part which is directed by the jointly accepted overall way, W. Such a view can allow one to accommodate the cases we present above where expertise is so widely distributed that members do not know-how to do anything but their own part of the joint action. It therefore allows one to develop an account of G-KH which does not reduce to the summation of individual know-how in the following sense: The individual members of the group may know-how to perform their part but their individual know-how depends on and is guided by there being a jointly accepted overall way, W, which is the way to perform the overall act of φ(e.g., playing Mozart's Symphony No 36)

This approach would represent a non-reductive theory of G-KH because it does not reduce the group's knowledge-how to individual member's knowledge. It does, however, reduce G-KH to individual propositional attitudes—in this case, their *acceptance* that W is the way to do φ Therefore, since it reduces G-KH to the propositional attitudes of individual members it represents a form of intellectualism. But it may not be a viable form.

[6] See also Kallestrup (forthcoming) for a virtue reliabilist approach to group knowledge by acceptance.

According to intellectualism, knowledge-how is supposed to reduce to knowledge-that. In the proposed account, however, it could be that no one knows that W is the way. The members merely *accept* that W is the way. This gives rise to the same worry we raised above: if no one actually knows that W is the way, then according to an intellectualist account, no one, not even the group, knows-how to do φ

Could the collective acceptance view be understood so as to avoid this worry? So far, we have been assuming that the collective acceptance account reduces group knowledge-that to individual members' mere acceptance of a proposition and that an account of G-KH based on this would reduce G-KH to individual members' acceptance of a way, W, to do φ even if such acceptance has not come about in a justified or reliable fashion.

Let us consider then a case where, even though no individual knows the overall way W, they *reliably or justifiably* accept that there is a way W, which is thereby known by the group to be the way to act *collectively*. In such a case, even if each individual does not know the overall way, W, they may at least know their part of W, which, now, is not merely jointly accepted but also—in light of the joint acceptance view of group propositional knowledge—jointly known. Then we could get a picture where the overall way, W, is only known by the group (because it is accepted by the members as such and the process of acceptance has somehow come about in a reliable or justified fashion). Individual knowledge of *pieces* of W are still possessed by and direct the activity of group members, but knowledge of the overall way, W, of which individuals' know-how form parts, is possessed by the group alone. In other words, in such a scenario, we have group knowledge of W and this piece of collectively known propositional knowledge guides the actions of the individual members. That would again amount to a form of non-reductive intellectualist account of G-KH.

Now this way of extending group knowledge-that to group know how assumes that there is a sense in which groups, themselves, know. The members accept that the group

knows W, and that W is the way to ϕ. Although both authors of this paper have previously argued (Tollefsen 2002, 2015; Palermos and Pritchard 2013; forthcoming, Palermos 2015, forthcoming*b*) that groups themselves can know-that, the idea is by no mean uncontroversial.

Moreover, there might be a technical problem with the above approach to irreducible G-KH. Notice that the original definition of intellectualist know-how states that, when someone knows-how to φ they know that *a* way, W, is the way to φ In contrast, in the case of intellectualist G-KH, we stated that when a group knows-how to φ its members jointly and justifiably accept that W is *the* way to φ There is a very good reason why, in the case of G-KH, as opposed to the case of individual know-how, the members of the group need to justifiably accept a *specific* way, W, as *the* way to φ To keep with our previous example, there might be more than one ways to perform Mozart's Symphony No 36 and yet in order for the members of an orchestra to collectively perform Mozart's symphony efficiently they must have jointly and justifiably accepted the same way, W, as the overall way to perform the classical piece (it requires little to no imagination to see that the result would otherwise be disastrous). But the crucial question then is this: How do the members of a group agree on what *the* way, W, to $\varphi$is?

Perhaps this is entirely the conductor's decision, which the members of the orchestra have to merely accept as their joint view. Or perhaps, before performance, the members of the orchestra along with the conductor get to jointly decide on the overall way, W—possibly another form of G-KH to be analyzed in intellectualist terms. But both moves seem implausible, because, presumably, no individual alone has the cognitive capacities to know or even believe the overall way, W. So, how could an individual like the conductor, or group of individuals reach a decision on a way, W, that cannot be grasped by any individual alone?

And what about cases of spontaneous, improvised performance of a group skill, such as tango dancing or jazz jamming, where no conductor or decision-making processes are present?

It seems that, contrary to the intellectualist approach to G-KH that we have laid out above, many times, groups of people manifest G-KH even though they have not previously jointly accepted a specific way, W, which is the way that they perform their collective skill. Instead, many times, it appears that the way, W, in which a group of people engages in G-KH arises *during* the process of their coordinated activity. Anti-intellectualist group dynamics might therefore be more fundamental than intellectualist commitments (cf. Tollefsen and Dale 2012) and perhaps the only necessary requirement for G-KH to emerge.

In what follows we consider an anti-intellectualist account of G-KH that does not rely on the idea of group propositional knowledge and consider whether that provides for a more palatable theory of G-KH.

IV. An anti-intellectualist approach to G-KH

Anti-intellectualism holds that know-how is a form of disposition or ability, that belongs to an intelligent agent, because, when manifested, not only can it be well regulated, but also performed in a *responsible* manner. Accordingly, in order to argue for the irreducibility of G-KH to individual know-how on the basis of anti-intellectualism we need to demonstrate that, on certain occasions, the anti-intellectualist demand that the relevant skill be responsibly performed can only be satisfied by a group of people as a whole. That is, successful group performance may not always be regulated by the aggregate of the members of the group, but instead by the synergetic operation of the group as a whole. To explain how this might be so, it is helpful to focus on the hypothesis of distributed

cognition, which postulates that certain cognitive abilities may be distributed between several individuals at the same time.

According to several philosophers of mind and cognitive scientists (Barnier et al. 2008; Heylighen et al. 2004; Hutchins, 1996; Sutton et al., 2010; Sutton, 2008; Theiner et al. 2010; Theiner, 2013a, 2013b; Tollefsen & Dale, 2012; Tollefsen, 2006; Wilson, 2005; Palermos forthcoming*a*) when team members cooperatively interact in order to bring about a task that we would readily classify as cognitive—e.g., decision-making, remembering (Wegner et al. 1985, Wegner 1986, 1991, 1995), performing an experiment (Giere 2002a, 200b, 2006, 2007, Palermos 2015)—we can view the relevant group as an integrated distributed cognitive system in its own right.

To understand the motivation for this claim, it is helpful to consider Dynamical Systems Theory (DST), which is the best mathematical framework for studying and modeling the behavior of dynamical systems, in general. According to DST, in order to claim that two (or more) systems give rise to some distributed process and, thereby, to an overall distributed system (or to a *coupled* system, in DST terms), we need to establish that the contributing parts are non-linearly related to each other on the basis of *continuous reciprocal interactions* between them (Chemero 2009, Froese et al. 2013, Sutton et al. 2008, Theiner et al. 2010, Wegner et al. 1985, Tollefsen & Dale 2011, Palermos, 2014b, Palermos forthcoming*a*). The underlying rational is that non-linear relations between parts give rise to an overall *non-decomposable* system that consists of all the contributing subcomponents operating in tandem.

There are two reasons for postulating the overall coupled system: (1) The aforementioned non-linear interactions give rise to new systemic properties that belong only to the overall system and to none of the contributing subsystems alone. Therefore, to account for these new systemic properties, one *has to* postulate the overall extended or distributed system); (2) Said interactions also make it impossible to decompose the two systems in terms of distinct inputs and outputs from the one subsystem to the other. The

reason is that the way each system behaves is simultaneously dependent on the behavior of the system it is mutually and continuously interacting with. Consequently, in order to account for the way those two mutually interdependent systems operate, one *cannot but* postulate the overall system that consists of both of them at the same time.[7]

According to DST, then, in order to have an overall distributed cognitive system—as opposed to merely several individual cognitive systems that are socially embedded (cf. Adams & Aizawa, 2001, 2010; Rupert, 2004, 2009)—the requirement is that the contributing members (i.e., the relevant cognitive agents) collaboratively perform a cognitive task by interacting continuously and reciprocally with each other.

The above provides a rationale for the necessity of postulating distributed cognitive systems. Additionally, it can also highlight the sense in which the G-KH of distributed cognitive systems *emerges*. The starting point is to note that emergent, collective properties refer to *regularities* in the behavior of the group as a whole. Each token instance of any such behavior may still, in principle, be performed by a single individual or at least by a random collection of them. But in order for such behavior to be regular, the group entity must be in place.

For example, it is not hard to imagine that, in some strange turn of events, a single individual or an unrelated collection of individual musicians, who fall short of forming a band, could realize processes that are identical to the processes of some time slice of a jazz band improvisation. Such a lucky arrangement of events, however, would only *resemble* a real musical improvisation, as it is impossible for the processes that are constitutive of proper jam sessions to be sustained and *regularly* performed in the absence of some jazz band as a *whole*.

[7] To preempt a possible worry, here, the relevant reciprocal interactions need only be continuous during the operation of the relevant coupled cognitive system and the unfolding of any processes related to it. For example, if, as part of her job and during normal working hours, individual *S* participates in distributed cognitive system *X*, *S* does not need to continuously interact with the other members of *X*, when she is at home. However, whenever *X* is in operation, *S* must continuously and reciprocally interact with the rest of the *X*-members. For a detailed explanation of why the existence of non-linear relations that arise out of reciprocal interactions between agents and their artifacts ensures the existence of extended cognitive systems see (Palermos 2014b).

In other words, any behavior that could be classed as the manifestation of some system's know-how (such as the set of processes giving rise to jazz improvisation) cannot count as such if it is merely the product of all the necessary ingredients momentarily coming together in a fleeting way. The relevant behavior needs to instead arise out of the *cooperative* and (thereby) self-regulatory activity of some appropriate collection of units that will allow it to be (at least potentially) *regular* behavior.[8] A group of random musicians, for example, cannot qualify as a jazz band when they play their instruments individually, even if, momentarily, the outcome does turn out to be harmoniously and rhythmically appropriate. Instead, in order for them to qualify as a jazz band, they must regularly be in tune and in synch, and for that to be the case, every player's performance must be continuously interdependent to everyone else's.

This also explains what the connection with the above points regarding the necessity of postulating distributed cognitive systems is. According to the DST arguments for postulating coupled systems, the existence of the requisite cooperative (non-linear) interactions between the individual members of the group and the emergent properties these interactions give rise to (e.g., rhythmic and harmonic coordination) renders the postulation of the group entities necessary.

The main idea, then, behind the emergence of G-KH is this: 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 constrains, 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. This process of "self organization and further evolution of the collective" as

[8] Coey, Varlet and Richardson (2012) also note that "behavioral regularity in joint actions can be understood as an emergent property of the lawful constraints that bind co-actors to behave as a unified, functional whole."

Heylighen et al. put it (2004, p. 6), "effectively creates a form of 'social' organization in which agents help each other so as to maximize the collective benefit."

In such cases, short of postulating the relevant collective (group) entity, it is impossible to account for the individual members' restrained behavior. A behavior that results from the members' coordinated activity and which gives rise to emergent properties in the form of unprecedented regularities in the behavior of the group as a whole.[9]

DST therefore demonstrates that G-KH can be seen as an irreducibly emergent, collective phenomenon. Additionally, the above points also indicate why G-KH might be seen as a collective phenomenon from the point of view of Ryle's anti-intellectualism. Recall that according to Ryle,

> To be intelligent is not merely to satisfy criteria, but to apply them; to regulate one's actions and not merely to be well-regulated. A person's performance is described as careful or skillful, if in his operations he is ready to detect and correct lapses, to repeat and improve upon successes" (Ryle, 2009)

According to Ryle then, in order for some successful performance to qualify as manifesting know-how, it must not only be *de facto* reliable, but its success must be the product of being well regulated by an appropriate agent, who may be deemed responsible for it. One possible way to argue for G-KH, therefore, is to demonstrate that there are performances whose reliable successes are regulated by a group of people as whole. Drawing on the above, it is possible to provide an explanation of how such collective responsibility may arise when the members of a group are mutually interdependent.

As Heylighen et al. (2007) note, when the individual members of a team are mutually interdependent, they can form collective entities that *self-organize,* in order to bring about some desired result that maximizes the collective benefit. The main idea is that such collections of people tend to interact until they evolve to a stable configuration of states. Once the system has achieved this stable configuration, its component parts have

[9] For a detailed defense of group properties and entities on the basis of a naturalized version of emergence, see (Palermos, forthcoming*a*).

mutually adapted by restricting their interactions to those that allow them to accomplish their end (the end, amongst other things, could be fitness, profit, or, in the present case, successful performance). This process of self-organization ensures the reliability of the collective performance. Otherwise, the collective would not have accomplished its end of performing successfully—thereby dissolving—or would have given rise to another internal configuration and, thus, to a different skill set that would have been more appropriate (i.e., more reliable). The mutual interdependence of the individual members of the group therefore explains how the group self-organizes to eventually bring about a structure that supports successful performance.

At the same time, the same kind of mutual interdependence between individual members explains how the group can regulate its skill at the actual time of performance. The reciprocal and continuous interactivity between the members of the group allows them to keep monitoring each other's performance, such that were there, at any given time, something wrong with the overall process, then it would become noticeable by at least one member of the group, allowing the group to respond appropriately. In the case of the jazz band, for example, if, say, the trombonist is out of rhythm, the drummer will notice this and try to compensate for it, by slightly changing her beat. Simultaneously, since every member of the group is also continuously interacting with the drummer, this will set the whole of the group back into rhythmic coordination and the overall process of the jazz improvisation will reliably continue without any noticeable disruptions.

Conversely, if there is nothing wrong with the overall process as it unfolds over time, the group will again count as responsible for its successful performance *by default.* This is because, so long as the group can become aware that there is something wrong with the overall process on the basis of its members' mutual interactivity, then the group can take itself to be acting responsibly, provided that no member has in fact expressed any negative reasons against its performance. For example, in extreme cases, the drum player could give visual or even verbal hints to the trombonist that he's lost his concentration and that he fails

to follow the band's rhythm, despite her best attempts to 'bring him back'. So long as no such obvious mishaps occur, however, the group can keep performing responsibly even if it occasionally employs its self-regulatory mechanisms in order to correct its performance when it deviates from its normal reliability. Crucially, this is a form of responsibility that does not require that the group as a whole or any of its individual members possess propositional knowledge of a way, W, that indicates how to perform the relevant skill. It only requires that its members continuously interact with each other and that this ongoing interactivity gives rise to no doubts against the ongoing performance.

The ability then of the cognitive ensemble to regulate its successful performance by appropriately responding in cases where there might be something wrong with some part of the overall distributed process is solely the product of the members' reciprocal interactivity, which binds them together into a unified whole. Conversely but similarly, when there is nothing wrong, it is again the decentralized, distributed activity, running in the background, that allows the group to be *by default* responsible in generating successful behavior.

Overall then, the mutual interdependence between the members of the group gives rise to responsible group performance both in a *diachronic* and a *synchronic* manner. During the development of the group, the mutual interdependence of the members allows them to self-organise into an overall system that can reliably bring about the desired intelligent performance. Then, on the basis of this *self-organised* structure, the members of the group can mutually interact with each other in order to allow the group to *self-regulate* its performance at the time it takes place.

The distinction, of course, between *diachronic* and *synchronic* responsibility as well as the distinction between the respective underlying mechanisms of *self-organisation* and *self-regulation* are largely theoretical artifacts. In reality every instance of self-regulation can contribute to the process of the group's self-organisation and *vice versa*: The diachronic structure of the group is always shaped by and at the same time shapes its ongoing performances in real time.

In either case, the upshot is that the resulting form of (diachronic as well as synchronic) responsibility is not the product of adding together the individual know-how of the members of the group. Instead, it arises out of the synergetic cooperation of the members of the group. According to DST, this is an emergent process that belongs to a distributed system consisting of all the contributing individual members at the same time. In such cases, what renders the successful group performance into an intelligent skill is not the aggregate result of the members' individual skills, but the operation of the group as a whole. On the basis of anti-intellectualism on know-how, we may then view such skills as the skills of the overall group, or in other words, as irreducible G-KH.

In comparison to its intellectualist, joint-intentionality alternative, the above anti-intellectualist account to G-KH provides perhaps a more detailed explanation of the sense in which G-KH might be irreducibly emergent without appealing to propositional knowledge of an overall way, W, that is *the* way to φ. Yet, it is still a tentative account, because, just like the joint intentionality approach to group knowledge, so the hypothesis of distributed cognition is being widely debated within the literature.

V. Is G-KH Intellectualist, Anti-Intellectualist, or Both?

Given the controversial status of both the joint intentionality and the distributed cognition hypotheses that underlie the above intellectualist and anti-intellectualist accounts there is no clear-cut way of choosing between the two. Nevertheless, in this final section we note that, perhaps, in order to account for many instances of irreducibly collective G-KH, both approaches might in fact be required. The reason, again, has to do with the notion of responsibility.

As we saw in the previous section, even though the intellectualist and anti-intellectualist approach to collectivist G-KH might be equally controversial, the latter might be better suited for explaining the collective nature of G-KH by providing a collectivist

account of the underlying responsibility in the way Ryle understands the term. That is, the ability to self-organise and regulate the relevant know-how belongs to the ongoing interactivity of the members of the group and thereby to the group as a whole.

From the point of view of anti-intellectualism, this form of collective responsibility is sufficient for accounting for G-KH. Nevertheless, there is also the intuition that, many times, G-KH carries an additional form of responsibility, which depends on the explicit propositional commitments that the underlying members of the group undertake. Consider, for example, the contracts that professional sports players sign. Many times, such explicit commitments seem necessary in order for the group to be in a position to self-regulate in the way the anti-intellectualist approach requires.

This is an intuition that the intellectualist approach to G-KH can easily accommodate. Consider, for example, Bratman who notes that in order for two individuals to engage in joint action, the following propositions must be part of their common beliefs, acceptances or knowledge:

> (a) I intend that we J and (b) you intend that we J
> (c) I intend that we J in accordance with and because of (a) and (b), and meshing subplans of (a) and (b)

We are here interested in Bratman's point that all parties should intend to J in accordance with (a) and (b), *and meshing sub-plans of (a) and (b).* As Bratman (2006, 3) explains

> My intention that we J by way of your analogous intention and meshing sub-plans imposes rational pressure on me, as time goes by, to fill in my sub-plans in ways that fit with yours as you fill in your sub-plans; and vice versa. This pressure derives from the basic rational pressure on me for means-end coherent and consistent plans, given the ways in which your intentions enter into the content of my intention.

Bratman is clearly onto something. But it is also interesting to ask whether this type of explicit commitments on the part of the individual members of the group are always required in order for G-KH to arise. To successfully answer this question, it is helpful to hint at a point we made earlier concerning the *emergence* of G-KH. Emergence, we noted, refers to higher-order properties, manifested as unprecedented whole-system regularities

that arise out of the *restrained* behavior of the components of the relevant system. In the case of G-KH, this means that the group activity referred to as G-KH is a regular behavior on the part of the team, which would not manifest itself were the members of the team to act on their personal interests alone.

For example, football players might be individually better off to show off their dribbling skills instead of carrying out the far-less exciting role assigned to them as part of the team strategy. Nevertheless, it is only when they suppress their individual urge to act in a selfish manner that the team skill can be manifested. In order for this to happen, the team members need to be explicitly committed to act as parts of the team, such that their behavior will mesh with the actions of the other members. Yet a number of studies also indicate that certain forms of joint action and G-KH, such as interpersonal rhythmic coordination,[10] can spontaneously emerge on the basis of dynamical processes of interaction—without the further need, on the part of the individual members, to take up any intellectualist commitments.

To reconcile the above tension with respect to how important intellectualist commitments might be for the emergence of G-KH, we may put forward the following tentative hypothesis:

> Hypothesis of Coordinating Intellectual Commitments
>
> The more likely are the members of the relevant group to deviate from the coordinated activity that gives rise to the group's G-KH, the bigger the need for the members of the group to undertake intellectual commitments to coordinate.[11]

[10] See for example (Bressler, S. L., & Kelso, J. A. S., 2001; Coey, C. A., Varlet, M., & Richardson, M. J., 2012; Dale, R., Fusaroli, R., Duran, N., & Richardson, D. C., 2013, Marsh, K. L., Richardson, M. J., & Schmidt, R. C., 2009; Riley, M. A., Richardson, M. J., Shockley, K., & Ramenzoni, V. C., 2011; Tollefsen, D., & Dale, R., 2012) and engaging in dialogue (Fusaroli, R. Rączaszek-Leonardi, J. Tylén, K., 2014; Fusaroli, R., Gangopadhyay, N., & Tylén, K., 2014; Fusaroli, R., & Tylén, K., 2015)

[11] Adam Carter has pointed out to us that if this tentative hypothesis—according to which many instances of G-KH require a hybrid analysis—is true, it would seem as though it should apply no less to the individual level. And that would be a substantial argument to try to defend; it would involve arguing that most prevailing accounts of know-how at the individual level are incorrect, and that a hybrid account is superior. We think that we can avoid the dialectical burden of explaining why a hybrid view might be required at the group level but not at the individual by pointing to the following disanalogy. Unlike the case of G-KH where the component parts of the realisation basis of the relevant skill are complex individuals with potentially contrasting intentions, the realisation basis of individual know-how are well integrated parts of a single brain/organism. It would then seem that no explicit conscious commitments about how to perform a skill are

This is where we believe intellectualist commitments come into play. Their role is to prevent the behavior of the individual members of the team from deviating from the individual behavior that is required for the team to coordinate—or, perhaps somewhat more weakly, intellectualist commitments disallow team members to engage in behavior that would prevent the team from acting in a sufficiently coordinated manner. Either way, the suggestion is that "the commitment to joint action maintains a form of stability of agency" and presupposes that the participants are also willing to provide mutual support (Tollefsen 2006). Sometimes, the complexity of the relevant G-KH, the context within which it is practiced or the nature of the team members makes them prone to deviating from their coordination routine and instead engaging in selfish behavior. In such cases, intellectualist commitments can act as an extra reflective layer that provides the members with additional reasons for appropriately engaging in the team's coordination dynamics.

Undertaking such explicit contractual commitments also explains the sense of additional responsibility that seems to be present in some cases of G-KH, but not in others. Having been verbally committed to contribute to the plans of the group leaves no room for doubt about how one is expected to behave if one desires to be part of the team. In line with actual practices, breaking one's commitments sanctions a form of individual punishment that does not seem to be in order in the case of humans that engage in G-KH but with no such prior verbal commitments. Undertaking explicit verbal commitments, then, carries a reflective form of responsibility on the part of the individual members of the group that seems to be absent in cases of spontaneously formed G-KH.

Perhaps this form of intellectualist responsibility cannot explain the collective nature of G-KH or the form of anti-intellectualist responsibility that arises on the basis of the group members' ongoing interactivity. Nevertheless, it seems to be necessary for understanding why, on a number of occasions and especially in cases such as sports-team

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necessary in the case of individual know-how and that some form of anti-intellectualism could perhaps represent an adequate, non-hybrid view of individual know-how.

performance, one may not just blame or praise the team as a whole but also the individual players, depending on how well they managed to serve their commitment to the team.

Conclusion

Although there has been a great deal of work done on joint action and some work done on group knowledge the latter has focused on group propositional knowledge and the former has not focused on skilled action. In this paper we considered a number of ways in which we might understand G-KH. We began by considering whether G-KH might be reduced to the aggregation of individual know-how within a group. For a variety of reasons we dismissed this approach. We then considered whether an intellectualist account of G-KH might be developed that appeals to a theory of group knowledge that is based on collective acceptance of a proposition. Finally, we offered an anti-intellectualist account of G-KH that views certain groups as dynamical systems and skilled action as an emergent result of the complex interactions between group members. While more work needs to be done to flesh out the details of the above accounts, we concluded that the analysis of many cases of G-KH is likely to require both.

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