

**Collective science:
How to describe, measure and study collective understanding?**

Short abstract: 138 words

This talk is devoted to trying to clarify under which conditions a scientific group can be said to have scientific understanding of an item of knowledge. In the first part of the talk, I argue that the possession scientific understanding is a specific problem for collaborative science, even if it has so far been largely ignored by philosophers of science and social epistemologists. In the second part, I argue that the understanding possessed by groups can be studied by focusing upon which sets of understanding-denoting questions they can answer and I show that this instrumental approach is compatible with most approaches about understanding. In the final part of the talk, I highlight typical situations of distribution of scientific knowledge and abilities within groups and analyze which set of understanding-denoting questions the corresponding groups can answer in each case.

Long abstract: 1012 words (without references)

This talk is devoted to trying to clarify under which conditions a scientific group can be said to have scientific understanding of an item of knowledge. In the first part of the talk, I argue that the possession scientific understanding is a specific problem for collaborative science, even if it has so far been largely ignored by philosophers of science and social epistemologists. In the second part, I argue that the understanding possessed by groups can be studied by analyzing which sets of understanding-denoting questions they can answer. In the final part of the talk, I highlight typical situations of distribution of scientific knowledge and abilities within groups and analyze which set of understanding-denoting questions the corresponding groups can answer in each case.

As far as scientific results produced by individuals are concerned, understanding does not seem to be a crucial issue for philosophy of science and this notion has attracted far less attention than its more objective correlates such as explanation or knowledge. For example, Hempel defines understanding as a purely psychological notion, which is a subjective by-product of the production of explanations. In this perspective, understanding carries little if any epistemic relevance and from this point of view it does not deserve any meticulous epistemological analysis (Hempel 1965, 413), even if it may be a phenomenon of interest for those carrying research in psychology or pragmatics.

Positions of this type are for a part legitimate in the context of individually-made science. After all, when a scientist produces an explanation, she is supposed to be able to master it. From this point of view, it is clear that individually produced explanations can be grasped by a human mind and that at least some individuals do benefit from the understanding they provide and can build on this it to go further in investigations, anticipate new results, take the right orientations in searching, see how phenomena are connected, control them, see how things may have been different under different circumstances, or simply apply science.

Things turn out to be different in the context of collaborative research. Explanations, proofs, predictions, etc. are more and more produced by large groups of scientists. Further, in the case of what Thagard (1997) calls peer-different collaborations, the

different scientists involved do not have the same knowledge and skills and they play different non substitutable role in the making of knowledge. From this point of view, it can no longer be safely assumed that some individuals can completely master the item of knowledge that are produced and therefore benefit from the understanding it offers.

So the question rises: how much scientific understanding remains in this new regime of science? One can indeed i) grant to social epistemologists that some communities do possess collectively some scientific knowledge because they have together some true collective beliefs that are the outputs of some well-behaved (e.g. veridical) scientific practices or are justified by some collectively built justifications ii) but still claim that in this new realm of knowledge, there is very little or even no scientific understanding of the results of these scientific collaborations. And if one considers that having full-blown knowledge does not merely amount to possessing a true justified belief and that having understanding is something additional, independent, valuable, and perhaps crucial within science, then the social epistemologist may feel there is here a new task to be fulfilled: first describing how the products of collaborative science are in a sense still partly understood (descriptive task) and, second, assessing how much this understanding can be developed (normative task).

To tackle the question of group-understanding, I instrumentally adopt for the purpose of this talk a liberal stance towards the notion of understanding and remain agnostic about its supposedly mental nature. I shall examine whether groups of scientists can have, at least in part, the abilities associated with understanding and under which conditions these abilities can be developed. More specifically, I focus upon the ability by a group to answer understanding denoting questions, in particular what-if questions (Woodward, 2003) and argue that this instrumental approach is compatible with most approaches about understanding.

Opting for a deflationary account and a specific ability does not put an end to this definitional investigation. The question “how much exchanges do we let the members of a group have before they are summoned to provide an answer to a particular what-if question” remains. Two main types of options are available. First we can let them have as many exchanges as their organization make it possible. But we can also decide that an answer should immediately be given by a member of the group on the basis of the individual understanding of the result that their collective activity has enabled him to have. With this latter notion, the understanding of a group can be simply characterized as the aggregation of the partial understanding of the individuals that compose it.

The first option is clearly more encompassing because any answer that can be immediately given can be also given after some exchanges have been made. The second notion describes a more robust and immediate understanding because its delivery does not depend on contingent matters of fact as the actual possibility for a group to have the opportunity to mobilize and engage in possibly long scientific exchanges. In any case, I argue that both options are acceptable but that they provide more or less stringent notions corresponding to different types of understanding that a group can be described as having.

In the last part of the talk, I study different typical cases of groups, in which knowledge and skills are differently distributed and analyze which sets of questions they can answer. I focus in particular upon i) the historical case of human computers, in which groups of a few dozens of humans organized by a few engineers were used to solve ballistic problems in the XIXth and XXth century; ii) tasks in which scientific labor has

been for a great part modularized into physical modules; iii) cases in which the different modules involve physical variables that are in addition logically independent.

References

Goldman, Alvin, 1999, *Knowledge in a Social World*, Oxford: Oxford University Press.

Hempel, C., 1965, *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science*, New York: Free Press.

Thagard, Paul, 1997, "Collaborative Knowledge", *Noûs*, 31-2, pp. 242-261.

Woodward, J., 2003, *Making Things Happen: A Theory of Causal Explanation*, Oxford: Oxford University Press.