Group Epistemology Essay

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1 Group Epistemology

Epistemology is the study and philosophy of learning, belief and knowledge. Traditionally, epistemology is centered around the individual — how one person should learn about the world around them, what knowledge a person has, and what justifies a certain level of belief in a proposition. Group epistemology asks these questions not of individual agents, but *group* agents.

It often makes sense to ask what a group believes. For example, does a board of investors anticipate their company becoming profitable? Does a jury believe a defendent is innocent? What is the consensus opinion of a panel of climate scientists? What does a team of pundits jointly anticipate the Liberal Party's primary vote percentage to be? In each of these cases, we're not interested in the opinions of any individuals in the group. We're interested in the group's overall opinion, because the group itself has some sort of authority over and above the individuals who comprise it.

Although group and individual epistemology share the goals and concerns, group epistemology involves several problems which individual epistemology does not face. For example, how do we aggregate the beliefs of many individuals into one group belief? How many individuals in a group are required to possess some piece of evidence before we can safely say the group as a whole possesses it? How do we resolve contradictions between the beliefs of different group members? These issues simply don't present themselves when considering the beliefs, knowledge and reasoning of individuals. This paper aims examines the specific question of *group credence*: how do we determine the credence[1] a group has in a given proposition?

[1] In this paper I will use 'belief' to designate a binary propositional attitude (agents do or don't believe a certain proposition) and credences as probability assignments (an agent may assign probability 0.3 to a proposition being true).

One intuitive solution to the group credence problem is known as *unweighted linear averaging*. In this scheme, groups should just average every individual's credence in a proposition to get the overall group credence. Unfortunately this approach yields poor results in a number of cases, which I shall examine below. A variety of more complicated procedures have been proposed which aim to succeed where unweighted linear averaging (or other approaches) fail. In this paper, I will examine a recently-published theory, Dietrich & List (2013)'s *Probabilistic Opinion Pooling* (hereafter POP) and evaluate its success as a solution to the group credence problem.

2 Evaluating group credence procedures

To demonstrate the complications inherent in group credence functions, I will examine scenarios where the unweighted linear averaging rule yields poor outcomes. Later in this paper I will use these same scenarios to evaluate how successful POP is as a group credence procedure.

In order to outline unweighted linear averaging I must first define some terminology. Call a *credence function* a function which maps propositions to probabilities (between zero and one). Given a group G of n individuals and a list of their credence functions $CR = \langle cr_1, cr_2, ..., cr_n \rangle$, unweighted linear averaging says that the credence function for the entire group G is

$$cr_G(P, CR) = \frac{1}{n} \times \sum_{cr \in CR} cr(P)$$

Russell et al. (2015) outlines a number of properties which are *prima facie* desirable in group credence functions. Unweighted linear averaging has a number of these properties, such as

- **Anonymity**: if CR' is a permutation of CR, $cr_G(P, CR) = cr_G(P, CR')$ (i.e. the identity of each individual doesn't matter, only their credence).
- **Systematicity**: the credence of a specific proposition P is a pure function of each individual's credence in P, and nothing else — neither credences for other propositions, nor outside information beyond credences will affect the output of CR.
- **Unanimity**: if each individual in the group has the same credence for P, then the group should have that credence too.

- **Continuity**: small changes in the input individual credences should lead to small changes in the output group credence, i.e. $cr_G(-, CR)$ should be a continuous function.

Unweighted linear averaging has **anonymity** because it treats every individual in the group the exact same way. Anonymity is motivated by considerations of fairness — a group should use information from all its members equally, and not privilege one member above others. There shouldn't be a small minority responsible for the group's decisions, and there certainly shouldn't be a *dictator* individual whose credences determine the entire group's.

The procedure meets **systematicity** because it calculates the group credence for a proposition using only the individual credences for that proposition (averaging them). Systematicity is desirable because otherwise group members could manipulate the group's decision by introducing other propositions or outside information (sometimes called 'irrelevant alternatives')

Unanimity is a natural consequence of using averaging: if all the numbers being averaged are equal, then the average will be that value too. Unanimity has an intuitive appeal — if every member in the group agrees, then there's no dispute to even resolve, and thus no need to consult a group credence function. Unweighted linear averaging's **continuity** comes from the linearity of averaging generally: if you slightly change one of the numbers being averaged, you'll only change the average a slight amount. This has some intuitive appeal but is less motivated than other properties.

Unfortunately, unweighted linear averaging fails to meet several other important criteria of a good credence aggregation function. Firstly, it fails to *commute with conditionalisation*. As Russell et al. (2015, pg. 1290) puts it, "if every individual updates on new information by conditionalizing, the resulting average credence wont be the same as what they would get from first averaging their unconditional credences in each proposition, and then conditionalizing on the new evidence." Unweighted linear averaging doesn't respect conditionalisation (Loewer & Laddaga, 1985, pg. 87), which has serious consequences.

If each individual conditionalises on evidence, and then the group credence is recalculated, the group's final credence function won't be the same as its old credence conditionalised. This means the group can now be tricked into buying a Dutch Book — "a set of bets bought or sold at such prices as to guarantee a net loss" (Hájek et al., 2008). Generally, an agent is considered irrational if they would ever possibly buy a bet which is guaranteed to lose them more money than they paid for it. Therefore, any group whose credences do not commute with conditionalisation opens themselves up to irrational behaviour — certainly not a desirable property of a credence function.

Unweighted linear averaging also fails at what I call the **Elephant Test**. In the ancient fable, three blind men come across an elephant and each touches a different part of it. One man touches its trunk, and concludes the animal is a snake. One man touches the tail and concludes the animal is a horse. One man touches the leg and concludes it is a rhinocerous[2]. Let $H_{elephant}$ be the hypothesis that the three men have encountered an elephant.

No individual in this group has sufficient evidence to believe $H_{elephant}$, and therefore they would each assign low credence to it. The first individual would give high credence to H_{snake}, the second would give high credence to H_{horse} and the third would give high credence to H_{rhino}. This means that when the group's unweighted linear average credence is taken, the group will jointly assign low credence to $H_{elephant}$ (because the average of three small numbers is itself a small number).

Notice, however, that between the three members the group does possess enough evidence to jointly confirm $H_{elephant}$. An elephant is the only animal with the sort of trunk, legs and tail the men encountered. A good group credence procedure, therefore, should be justified in assigning high credence to $H_{elephant}$. This demonstrates a general failing of unweighted linear averaging — it fails to make proper use of the evidence available to the group.

Passing the Elephant Test is absolutely vital for a group credence procedure. Failure indicates that the group is not making proper use of all the information (and/or evidence) available to its members. I believe misidentifying the elephant in this case demonstrates irrationality at a group level.

Of course, not all mistakes at a group level demonstrate irrationality. Some mistakes just demonstrate lack of information: for example, if the group lacks evidence for a proposition, then it is in fact *rational* to assign low credence to that proposition. This does not hold in the Elephant Test — the group jointly possesses evidence necessary to justify high credence.

Mistakes based on probabilistic outcomes are also not evidence of irrationality: if a group assigns credence 0.5 to a fair coin landing heads, and it lands tails, this is not a failing of the group. It is merely an inevitable consequence of

[2]Estlund (2009, pg. 229) uses this fable as an example of voters who do not have accuracy above 50%. I attribute my recognition of the fable's philosophical significance to him, however he uses the fable for a completely different purpose to me.

judgement under uncertainty.

However, failing to identify the elephant is unlike these failures. Unweighted linear averaging groups fail to identify the elephant not because they lack information or evidence, not because of probabilistic failure, but simply because they *do not use the information available to them.* They ignore relevant evidence, which is surely a sign of irrationality.

To summarise: although unweighted linear averaging has a number of desirable properties (anonymity, systemacity, unanimity, continuity) it fails to commute with conditionalisation. Therefore, groups whose credences are chosen with this mechanism will be vulnerable to Dutch Books and can be easily exploited. It also fails the Elephant Test, which indicates it ignores relevant evidence possessed by group members. These are both serious problems and demonstrate the need for a more sophisticated group credence procedure, such as POP.

3 Probabilistic Opinion Pooling: POP

References

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