Eliminating candidates for best scientific theories

A justified, yet fallible, approach

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Samir Okasha (2011) uses social choice theory to gain insight into the Kuhnian claim that there is 'no unique algorithm' for choosing between rival scientific theories. By viewing epistemic virtues (such as accuracy, simplicity or fruitfulness) as rational agents ranking the candidates for the best scientific theory, Okasha transposes the problem of justifying choosing one scientific theory over another from the realm of philosophy of science into a problem that can be dealt using the tools of social choice theory. This move naturally leads him to discuss the Arrow impossibility theorem, according to which given a few reasonable restrictions that any choice algorithm should satisfy (unrestricted domain, weak Pareto, independence of irrelevant alternatives and non-dictatorship), in cases of three or more candidates no decision algorithm can emerge. Just as in social choice theory, it might be the case that no decision procedure to select the best scientific theory is possible. While according to both Kuhn and Arrow there is no unique algorithm to determine the best theory, where Kuhn sees an embarrassment of riches, Arrow sees a desert landscape.

Okasha explores how the various restrictions might be eased in order to avoid the Arrovian impossibility result and justifiably takes the position that it is probably the Independence of Irrelevant Alternatives (IIA) restriction which is the best candidate to be relaxed. He then explores Amartya Sen's 'Informational Basis' approach and how it might be applied to theory choice.

Following Mathew Coakley (2011), however, I propose a different approach to expanding the informational basis when selecting between various scientific theories based on how well they do from the point of view of epistemic virtues. In his paper Coakley frames the social choice problem of choosing the best policy, action or candidate (from the aggregate perspectives of the individuals choosing) as an epistemic problem, rather than a problem analogous to one of making interpersonal comparisons of subjective utility. Framed in this way makes it more similar to the epistemic problem of determining a best theory.

Coakley, proceeds to develop his argument by proposing to adopt two principles; unbiasedness - all information from the individuals (which in our case are the individual epistemic virtues) should be treated equally unless there is a positive reason not to, and coherence - justified beliefs about overall amounts of x should supervene upon beliefs about the particular amounts that make up x (whether x is length of string, the number of letters in a word, or utilities). Framed as an epistemic methodology for forming a justified belief about the overall social good rather than as an issue of attaining a justified institutional or procedural design, it makes sense to view the information available about how the options of interest stand relative to other alternatives and thus to reject the IIA.

Scientific theories might be judged by the various epistemic virtues, each potentially ranking a theory on either an ordinal, cardinal or ratio scale. With respect to each virtue we ought to be able to compare the theories and at the very least attain a partial ordinal ranking. If we cannot even accomplish this, then it can be granted that the specific epistemic virtue is useless for our purposes. If we cannot determine whether theory A is more, less or equally as simple as theory B, then of course simplicity will not tell us anything about how those two theories compare. If, however, we manage to get a partial ordinal ranking of theories for each virtue separately, then we might be able to determine which theory best satisfies the epistemic virtues overall.

If *all* the information we have is an ordinal ranking of theories according to each epistemic theory, then while unbiasedness requires us to weigh each virtue the same, coherence allows us to fallibly infer from how some rankings compare to others what subset of theories is the best.

Such a process might at best uniquely determine a single theory within the subset, or at worst simply include the whole original set, depending on how useful the ranking is for extracting additional information. Anything in between, however, will usefully narrow down the domain of candidates for the title of best scientific theory and as such brings us one step closer to the goal of determining what the best scientific theory is.

If we do have more information, such as some reason to give more weight to a certain virtue, or access to a cardinal ranking according to another virtue, such information ought to be taken into account when determining what the best theory is. How to do this is beyond the scope of this paper, and I suspect is determined more by how each particular science operates than can be given a general account of.

The claim of this paper is that even with only ordinal information, contrary to the Arrovian result, we are generally able to find a subset of theories that can be justifiably (though not infallibly) viewed as better than others (and if this subset includes only one theory, all the better).