Commentary on Gelman and Hennig in JRSS

"Statistics as logic"

Jan-Willem Romeijn

Faculty of Philosophy

University of Groningen

The paper by Gelman and Hennig contains a stimulating discussion on the intersection of statistics and philosophy of science. Considering the pivotal role of statistics in all empirical sciences, and the prominence of scientific method as a topic in philosophy of science, these two disiplines have much to offer to each other. In what follows I hope to illustrate that, by providing a further context for the virtues that Gelman and Hennig discuss.

It is customary in the philosophy of science to distinguish between epistemic and aleatory conceptions of objective probability. The ideal of objectivity can be pieced apart in a similar fashion, referring either to the virtue of correspondence to facts and eventually truth, or to the virtues of transparency, impartiality and, more generally, rationality. This distinction maps roughly onto the one between ontology and epistemology, between what there is and what we know. And as I argue below, it clarifies the respective roles of the virtues that replace objectivity.

Focusing on epistemology, both impartiality and transparency are aspects of a virtue that to my mind merits independent representation: *logical validity*. The idea is that statistical inference answers to an independently motivated and indeed fully objective rationality norm, namely probabilistic coherence. This core virtue ensures impartiality because it purges the inferences of substantive assumptions, and transparency because it brings those assumptions out as explicit premises. The virtue of logical validity thus forces statisticians to acknowledge their modelling assumptions, and the perspective-taking that it involves. Falling back on the traditional vocabulary for effect: it is precisely by making the subjective starting points of statistical inference explicit that we can truly maintain its procedural objectivity.

Moving from the rationality of statistics to the truth or falsity of its substantive results, notice that logical validity is defined as the conservation of truth through inference. Depending on the specifics

of the decision situation, researchers will take different assumptions as input to their statistical inferences. What matters to objectivity in the metaphysical sense, i.e., in the sense of delivering true results, is whether those assumptions are true. Accordingly, nothing in the dependency of statistics on modelling assumptions, or in the variety of perspectives adopted by researchers, prevents us from arriving at true conclusions about the matter at hand. Viewing statistics as a logic helps us to clarify what it takes to arrive there, and also saves us from relativism about what statistics can deliver.