ABSTRACT. Maxwell claimed that the electrostatic inverse square law could be deduced from Cavendish's spherical condenser experiment. This is true only if the accuracy claims made by Cavendish and Maxwell are ignored, for both used the inverse square law as a premise in their analyses of experimental accuracy. By so doing, they assumed the very law the accuracy of which the Cavendish experiment was supposed to test. This paper attempts to make rational sense of this apparently circular procedure and to relate it to some variants of traditional problems concerning old and new evidence.

1. INTRODUCTION

In a series of recent papers, Jon Dorling and John Norton have championed the cause of demonstrative induction in science, in which demonstrative induction means deductive reasoning from experimental evidence and general principles believed true to a particular theory or hypothesis. They have both argued that actual science contains demonstrative inductions and that demonstrative induction could and should have been used in particular historical instances. Norton claims that the use of demonstrative inductions in science helps explain certain continuities of scientific practice, and Dorling attempts to embed the use of demonstrative induction into a more general Bayesian account of scientific reasoning. Both Norton and Dorling contrast the use of demonstrative induction with conventional hypothetico-deductive wisdom, which holds that argumentation in science is restricted to (1) the derivation of experimental consequences from hypotheses or theories already in one's cognitive possession, and (2) the comparison of those consequences with actual experimental values. Finally, the use of demonstrative induction opens the door, or so Norton and Dorling claim, for philosophical investigations of the creation or development of hypotheses and theories, because they emerge, as it were, as deductive consequences of the experimental evidence and general principles.

Of course, we ought not to be tempted into thinking that demonstrative induction is a straightforward or mechanical method of discovery. (And I do not mean to imply here that Dorling and Norton are so tempted.) Scientific interest is reserved for significant theories and
hypotheses; not just any consequences of general principles and evidence will do. We should also remember that, while the theorems of a formal system may be recursively enumerable, they are by and large not recursive. So, even if a significant or interesting hypothesis has somehow been identified, proving that it follows from a selected set of general principles and evidence is not automatic. In other words, demonstrative induction is first and foremost a method of justification. The implied contrast then is between those strategies of justification that rely on showing that the evidence (or the evidence with some probability measure) follows logically or mathematically from the hypothesis or theory under consideration and those strategies that rely on showing the converse, that is, that the hypothesis or theory under consideration follows (perhaps with a probability measure) from the evidence. In order to capture this division conveniently, I shall use hypothetico-deductive in a somewhat expanded sense, namely, a justification will be called hypothetico-deductive exactly if one of its premises is that the evidence (or probability of the evidence) follows from the theory or hypothesis, and if fitting the evidence is a necessary but not sufficient condition for confirmation. In terms of the history of science, the distinction is between those cases in which scientists spend their time trying to tease out the experimental consequences of their theories and those cases in which they are trying to tease out theories from the experimental results. In a nutshell, Dorling and Norton are claiming that philosophers have overly restricted their interpretative or reconstructive repertory to the hypothetico-deductive.

This paper divides into two parts. In the first, I briefly consider some puzzles, concerning the relevance of ‘old’ and ‘new’ evidence, that arise when demonstrative induction is considered in a simplified abstract way. I then shift my focus to an actual case: Cavendish’s spherical condenser experiment and the electrostatic inverse square force law. Dorling gives this as an example of a “simple but nevertheless illuminating example” of demonstrative induction. As I hope to show, the interpretation of this experiment as a demonstrative induction goes smoothly only if we ignore the sensitivity claims, i.e. how accurate the experiment is, made by Cavendish and Maxwell. In particular, I shall show that Cavendish and Maxwell both assumed the inverse square law in their analyses of the accuracy of the Cavendish experiment, that is, they assumed the very law that the Cavendish experiment was supposed to test. Such a procedure would appear to warrant charges of begging