

RELIABILITY, VALIDITY AND THE EXPERIMENTAL PROCESS: A NEUROBIOLOGICAL CASE STUDY

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Reliability has traditionally been characterized by philosophers of science as a virtue of various aspects of experimentation including scientific methods and techniques, experimental arrangements, data and knowledge claims. I develop an account of reliability that restricts reliability ascriptions to processes involved in the production of scientific data. On my account, a data production process is reliable just so long as it results in statistically analyzable data that can be used as evidence for knowledge claims about effects produced in the laboratory. I use a case study from the neurobiology of learning and memory to show that if an investigator wants a data production process to be reliable, measures are taken to build such reliability directly into an experimental design and its adjoining protocol. In this way, the design and protocol can be understood to specify an idealized process type. Subsequently, when that process type is implemented repeatedly in the laboratory, steps are taken to ensure that each individual instantiation of the process type exhibits its fundamental and idealized features. In developing my account of reliability, I appeal to Goldman's (1979, 1986, 1994) process reliabilism as well as Woodward's (2000) and Mayo's (1996, 2000) accounts of the reliability of experiment. I identify what I take to be problems for applying Woodward's and Mayo's accounts of reliability to actual cases of experimentation in the biological sciences and show that my account overcomes such problems.

While the reliability of experimental processes is a primary goal of an investigator, achieving reliability often comes only at the cost of sacrificing the achievement of another desirable goal of experimentation namely, the validity of interpretive claims made on the basis of data obtained in the laboratory. I define validity in accordance with the ordinary language definition, as a feature that an interpretive claim has just in case that claim has a sound basis and is appropriate given the circumstances or context to which it is applied. I use the neurobiological study of learning in order to illustrate how an express commitment to achieving the goal of reliability has resulted in the invalidity of mechanistic claims about learning emanating from this area of research. I provide a set of guidelines geared to function to maintain the reliability and increase the validity of those neurobiological experiments under consideration. The proposals that I make rely on methodological tools that have been proposed historically by experimental psychologists and more recently, by cognitive psychologists. I claim that given the fact that validity has different parameters, any solutions must proceed in a piecemeal fashion. I arrive at the conclusion that at best we can achieve some middle-ground in terms of guaranteeing simultaneously the reliability of data production and any given parameter of the validity of interpretation. This coincides with what Galison (1987), Hacking (1983; 1991) and Cartwright (1983; 1999) have claimed about other laboratory and non-laboratory sciences.