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Hypotheses in Émilie Du Châtelet (1706–1749)

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Émilie Du Châtelet argues that hypotheses are necessary, fundamental tools for the progress of natural philosophy and for physics. In her *Institutions de physique*, she explores what kinds of hypotheses should be admitted in natural philosophy and what kinds should be avoided. Along the way, she challenges the two leading camps on hypotheses: the Newtonian and Cartesian conception of hypotheses. Du Châtelet first identifies a gap between (i) the principles of knowledge we accept and experimental procedures that we create and (ii) the true causes of natural phenomena. Her principles of knowledge (e.g., PSR, Law of Continuity, and Principle of Non-contradiction) seemingly constrain not only scientific theorizing, but also what is known to be possible and impossible and what is known to be possible and actual. She grants that true causes of nature may beyond the principles of knowledge that we rely on, and so because of this "one is obliged to be content with probable reasons to explain [the true causes of phenomena]." Thus, probabilities are way to close this gap, by offering a starting point to the process of scientific theorizing, which should lead us to discover what we can about the causes of nature. (Du Châtelet, 1742/2009). For her, admitting probabilities in science is practical and sometimes the only way to arrive at truth. So, hypotheses, insofar as she defines them as "probable propositions that have a greater or lesser degree of certainty," also have this more general role that she ascribes to probabilities (ibid).

While Du Châtelet briefly, discuss hypotheses' role in theory-mediating and in mathematics, I will focus on just two specific roles she attributes to hypotheses: as explanations of observed phenomena and as tools that prompt scientific experiments and discoveries. She identifies hypotheses' first proper usage as explaining observed phenomena by considering the case of Ptolemy's geocentric thesis: when natural philosophers accepted the Ptolemaic hypothesis, they eventually encountered anomalies and serious incompatibles between observation and what the hypothesis predicted. She relays that because of the issues this hypothesis faced, Copernicus was driven to test for a heliocentric hypothesis. She offers another case from astronomy in order to support the second role that hypotheses have: Kepler's conjecture of elliptic orbits. Kepler had sought to account for the observed and recorded deviations based on circular orbit hypothesis. This led to his hypothesis that the orbits are in fact elliptical—not circular. Du Châtelet sums up by saying that "it is to hypotheses first made and then corrected that we are indebted for the beautiful and sublime knowledge of which astronomy and its subsidiary science are filled at present" (ibid). So, if it weren't for the initial, incorrect hypothesis, we may have not arrived at Kepler's hypothesis. In addition to these two proper usages, Du Châtelet also suggests that "good hypotheses" must be proposed in accordance with epistemological principles and empirical principles: hypotheses must not be in contradiction with any principles of knowledge, such as the principle of sufficient reason, the law of contradiction, and more. Further, hypotheses should be offered only after all relevant empirical facts that pertain to the explanandum (the phenomena to be explained) are known and collected.

Du Châtelet not only argues for what counts as a good and proper use of hypotheses, but also argues against improper usages of hypotheses: hypotheses are not to be assumed as the truth, she asserts. To avoid this, one must judge how probable a hypothesis is, cautiously ensuring to not mistake it for the truth and to not prematurely reject it. Experiments are ways to test hypotheses, so if one such supposition has a (presumably) positive degree of probability, one may test to either falsify or confirm it. (It's unclear whether Du Châtelet conceives as probabilities as numeric.) Crucially, however, while only one falsifying experiment is sufficient to reject a hypothesis, one confirming experiment is not enough to admit it as a certainty or a truth. And even in these instances, it could be that only part of the hypothesis is confirmed or rejected, since Du Châtelet emphasizes that hypotheses may be true in some parts and false in others. To support her point, she surveys Newton's rejection of Descartes' version of the hypotheses of vortices, which was due to their incompatibility with Kepler's laws. She admits that while Descartes' version of the hypothesis was properly rejected, it could still be the case that there exists a viable, non-Cartesian hypothesis about vortices and celestial motion that is compatible with Kepler's laws (ibid).

Du Châtelet concludes her chapter by saying that hypotheses "become truths when their probability increases to such a point that one can morally present them as certainty…." Some examples of this are Copernicus' heliocentric hypotheses and Kepler's conjecture regarding the elliptical orbits of the planets. As a result of her analysis on hypotheses, she ultimately claims that hypotheses need not be banished from the sciences as long as natural philosophers abide by the proper rules and uses of hypotheses. For if they do, they will not err in mistaking falsehood or fables for truth and instead they will follow the examples of "Copernicus, Kepler, Huygens, Descartes, Leibniz, and M. Newton," who "all imagined useful hypotheses to explain complicated and difficult phenomena."

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