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*Expectation and Fairness in Huygens' "Value of All Chances"*

In "An Essay towards solving a Problem in the Doctrine of Chances", Thomas Bayes defines "probability" in terms of "expectation" rather than conversely, as is now standard. Bayes' definition continued the tradition of Fermat, Pascal, and Huygens, who studied expectation first-and-foremost and discussed probability only secondarily. Historians of probability now widely agree that (1) Bayes' definition was not circular because 17th and 18th century thinkers routinely defined "expectation" in terms of "fairness" in games of chance, and (2) "fairness" was a "nonmathematical" notion (e.g., see Daston (1995)).

I accept the first conclusion but reject the second. I argue that there is a mathematically rigorous definition of "fairness" that validates Huygens' proofs in "The Value of All Chances."

I conclude by defending a methodological precept. Existing scholarship on classical probability has focused on the definitions of "expectation" or "probability" offered by Huygens and Laplace, among others. By contrast, historians of geometry argue that Euclid's definitions are of little interest and that to understand Ancient Greek geometry, we must carefully study the implicit rules of inference in Euclid's work. Similarly, I argue that we must investigate the implicit rules and axioms used in the proofs in the "classical" theory of probability.