

## A History of the Heritability Coefficient Applied to Humans

Stephen M. Downes and Eric Turkheimer

The application of the concept of heritability to human beings has a complex history that has not been documented in detail. The notion of heritability itself, in its broad and narrow formulations, is usually attributed to Lush (1937). Lush's development of the heritability concept, however, was more of a formalization of pre-existing ideas than a novel discovery; moreover, Lush was concerned exclusively with applications to plant and animal breeding, as opposed to using the concept to understand variation in human characteristics, especially human behavior.

The history of the heritability concept is difficult to document because it does not have a clear beginning. The word "heritable" had a legal meaning in the Nineteenth Century, in the sense of inheritance of family estates. At that time the word was co-opted by Darwin, and especially Galton, to refer to a concept that was primitive biologically and entirely non-quantitative. Later, as Pearson, Fisher and Wright developed what was to become quantitative genetics, it became common to compute various ratios of genetic to phenotypic variance, although these ratios were not referred to as heritability *per se*. Fisher (1918) applied these ratios to human height, and Newman, Freeman and Holzinger (1937) computed them for cognitive ability in human twins.

WW-II imposed a hiatus on genetic research and the related horrors of American eugenics and the holocaust briefly transformed societal attitudes toward application of the heritability concept in humans. Not long after the war, however, rapid expansion of the behavioral sciences in American universities and the establishment of twin databases around the world led to a reinvigoration of human behavior genetic research, and following this, "heritability coefficients" were being applied routinely to all aspects of human behavioral differences.

All of this research has gone on without one shared, clear account of the meaning of heritability. Further, there is no shared account of how heritability applies to the Galtonian "nature-nurture" questions it is often presumed to answer. Lush's derivation of broad and narrow heritability depends on experimentally-imposed assumptions of independence and additivity that are inapplicable to humans, for whom questions of selective breeding are both impractical and immoral. Nevertheless, it is incorrect to conclude that heritability has no relevance whatsoever to human behavioral differences. Here we use the history and philosophy of heritability to clarify the concept and shine a light on its relevance and potential misuse in modern science.

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Newman, H. H., Freeman, F. N., & Holzinger, K. J. (1937). Twins: A study of heredity and environment. The University of Chicago Press