it takes us back to Mill's text and his original argument. West's presentation is clear, and is supported by good argumentation. I do not hesitate to recommend this book to everyone who is interested in Mill's philosophy.

Josip Talanga
Institute of Philosophy
Ulica grada Vukovara 54/IV, HR-10000 Zagreb
josiptalanga@yahoo.com

Neven Sesardić, *Making Sense of Heritability*, Cambridge University Press, Cambridge, 2005, 267 pp.

"The heritability of a trait in a given population tells us what proportion of differences in that trait is due to genetic differences. It provides an answer to the main question in the nature-nurture controversy" (p. 1). Reading this textbook-like definition of heritability in the introduction to *Making Sense of Heritability* by Neven Sesardić, associate professor in the Department of Philosophy at Lingnan University, Hong Kong, one could hardly imagine the scientific turmoil heritability has produced over the last thirty years. Yet it is true that the concept of heritability was (and still is) at the center of the fierce debate about the nature-nurture impact on human behavioral traits, since it represents the key concept in the scientific discipline of behavioral genetics. The core of this debate is the question of whether human behavioral traits are determined (or highly influenced) by the genetic makeup or by environmental factors present during human development. Although genetic causes are widely recognized as the determinants of many animal behavioral traits, the notion that this same explanation could be applied to humans was only rarely and quite hesitantly verbalized by geneticists, with (as expected) vociferous opposition from social scientists and philosophers. However, some of the strongest opponents of the hereditarian viewpoint are to be found among biologists and geneticists themselves. The reason for this peculiar situation lies in the fact that the concept of heritability has often been obfuscated by political misconceptions, and is automatically linked with racist ideology. Furthermore, understanding this concept requires some level of proficiency in statistics, genetics and cognitive psychology. So it is not surprising that it has provided fertile ground for misunderstandings and misuses. Neven

Sesardić endeavors here to "dispel a number of obstinate misconceptions and pseudo-arguments about heritability that have dominated the intellectual scene for too long and that have diverted scientific and philosophical attention from the really interesting issues" (p. 9). His arguments are presented in seven chapters, which I shall review one by one.

The first chapter, entitled "The Nature-Nurture Debate: A Premature Burial?", begins by examining the widespread view that the nature-nurture dilemma is a superfluous one, since both genes and the environment are necessary for an organism to develop. The author considers this to be self-evident, since neither of these alone can make an organism. He also tries to exculpate Francis Galton from the accusation that he was unaware of this simple fact. Galton, who tried to determine the influence of heredity on achieving eminence, has lately been accused of ascribing a genetic influence to traits that may have been caused solely by the environment. However, Sesardić cites a passage from Galton's *Hereditary Genius* which demonstrates that he was in fact quite aware of the methodological pitfalls he has been accused of ignoring. So if genes and the environment both shape the phenotype, what is all the fuss about? Well, the importance of these two factors is not equal, and this difference may be measured. Sesardić elegantly shows that the variance of a phenotypic trait in a given population represents the sum of both genetic variance and environmental variance, with heritability as the ratio of genetic variance within the total variance. This definition of heritability is referred to as "broad sense heritability", and is used throughout the book. Although a somewhat simplistic explanation (neglecting factor interaction, measurement error, and so on), it shows that knowledge about phenotypic, genetic and environmental variation can be used to calculate the proportion of variance of both genes and the environment in the total phenotypic variation. However, the problem is that heritability does not tell us much about the genetic causes of a trait, nor anything at all about the specific ways in which genes affect development. Yet that is not its purpose; it only shows us where to "dig" in order to get more information. (Most critics, it would seem, are unaware of this fact.) The next issue that Sesardić tackles is the heritability of monomorphic traits, i.e. those traits possessed by all members of a given population. These traits have zero heritability, despite being under genetic control (for instance, walking on two legs in humans). However, zero heritability shows that "genes are unimportant for explaining the existing phenotypic *differences* in the population in question" (p. 28), and not that they are unimportant for the development of a given trait. Also, if the trait is shared by all members of a population it can still be heritable, compared to another population. The rest of the chapter is devoted to debunking some of the "anti-hereditarian myths" advanced mainly by

philosophers. The most blatant of these is Stephen Jay Gould's criticism of George Morton's cranial capacity measures. In *The Mismeasure of Man*, Gould criticized Morton for deliberately distorting measures to conform to his "racist beliefs". But when John S. Michael remeasured Morton's cranial collection, he found no bias whatsoever.

The second chapter, with the title "A Tangle of Interactions: Separating Genetic and Environmental Influences", is devoted to the concept of interaction between genes and the environment. Some critics have pointed out that these two factors interact, and thus cannot be meaningfully separated. For Sesardić, the first step is to differentiate between the commonsense notion of interaction and the statistical one. The former states that one factor cannot produce an effect in the absence of a second factor. However, this is not a problem when measuring heritability. The statistical concept of interaction states that "the change in one variable does not always have an effect of the same magnitude: its effect varies, depending on the value of the other variable" (p. 48). Some of the arguments against heritability vanish when one definition of interaction is used consistently. Sesardić presents a case where statistical interaction does indeed make it impossible to measure main effects, but he also offers several arguments for why this does not apply to the nature-nurture debate. He stresses that "the existence of statistical interaction does not exclude *a priori* the possibility of main effects" (p. 54). The possibility of main effects despite the presence of interaction also makes it possible to assign quantitative values to the causes of individual events.

The next item "on the agenda" in this chapter is Richard Lewontin's criticism of the analysis of variance (ANOVA). Sesardić begins by setting out Lewontin's brick-mortar analogy. Lewontin argues that it is absurd to attempt to separate the influence of the bricks and the mortar in building a wall, just as it is absurd to separate the influence of genes and the environment. However, Sesardić points out that the nature-nurture problem is about populations, not individual entities like a wall. Furthermore, the task is to measure the effects of different kinds of genes and environments, which in Lewontin's argument would mean different walls built from different kinds of bricks and mortar. In such a case, it would certainly not be absurd to measure main effects. However, the principal argument against measuring main effects consists of three parts. First, there is statistical interaction between genes and the environment. Second, as a result, high heritability in one environment does not entail the same degree of heritability in a different environment. Third, and consequently, ANOVA is useless, because it is impossible to generalize its results. Sesardić devotes several pages to demonstrating that Lewontin's choice of graphs depicting strong statistical interaction and his use of empirical data are

highly selective and biased. Also, he shows that there are ways of acquiring causal knowledge without experimenting on humans, this being one of Lewontin's criticisms. Further, invoking the complexity of interactive processes does not mean that main effects cannot be found. Sesardić offers the lung cancer analogy, claiming that although the emergence of lung cancer must be a complicated process that depends on the interaction of myriad factors, we can still quantify the main effect of smoking on cancer. In addressing the generalizability problem, Sesardić shows that high heritability in one population is not irrelevant when estimating heritability in another. While it is true that there is no guarantee that the heritability value of one population will be the same for another, one can anticipate similar heritability values in similar populations. In addition, measures of the heritability of some human traits seem to exhibit great robustness across populations. Lewontin attempts to dismiss ANOVA as a tool of behavioral genetics, arguing that it gives us results only from very few of the possible environments. Accordingly, we need to have a variety of environments at our disposal in order to establish a causal relationship between factors and phenotype. But Sesardić sees this as asking for too much. He shows that very useful results are yielded under conditions far less demanding than Lewontin's.

The third chapter, entitled "Lost in Correlations? Direct and Indirect Genetic Causes", attempts to shed light on the concept of genotype-environment correlation, defined as "situations where two separate sources of phenotypic variance (genetic and environmental) happen to be correlated" (p. 89) or, more broadly, "cases where there is a correlation between a genetic and environmental characteristic, even when the genetic characteristic is not *directly* influencing the phenotype" (p. 89). This concept is often targeted by anti-hereditarians in order to discredit heritability, making use of both a conceptual and a methodological critique. One example of the conceptual critique is redheads: redheaded children (as determined by genes) are mistreated because of the color of their hair, thus giving them lower IQ scores. Anti-hereditarians point out that while the IQ difference between these children and others would be classified as heritable, the reasons for this difference are purely environmental (i.e. maltreatment). However, Sesardić warns that there are different types of G-E correlations, redheads being an example of the "reactive" one. An "active" G-E correlation refers to cases where individuals actively try to find an environment that is in accordance with their genetic makeup, i.e. more or less stimulating. In this case, environmental effects are an integral part of the genetic makeup, and "the phenotypic effects of such environments are indeed sometimes classified as heritable" (p. 94). Of course, the redhead example is totally different from an "active" G-E correlation.

Another argument involving redheaded children seeks to undermine the significance of monozygotic twin studies. It states that twin redheaded children reared separately would both be ill-treated, while blonde twins would be treated well (presumably due to their hair color); the difference in the trait in question would be the consequence of discrimination (i.e. the environment). However, the prerequisite for studying monozygotic twins is different environments (favorable and unfavorable) for every unit of a pair, and this is not the case in the second redhead example, which represents a "serious distortion of the way twin studies are used to estimate heritability" (p. 99). Sesardić repudiates the remaining conceptual arguments by citing different types of G-E correlations and carefully analyzing the concept of environment. He then turns to methodological arguments, which seek to discredit the concept of heritability by stating that there is no feasible way of separating genetic and environmental causes in a G-E correlation. Philip Kitcher criticizes monozygotic twin studies by arguing that the environments in which such twins are raised are more similar than the environments shared by ordinary siblings. But this does not in itself constitute an obstacle to monozygotic twin studies. If it could be shown that increased environmental similarity has no impact on the phenotype, one could still obtain valid heritability estimates. It should be noted that monozygotic twins do not, in fact, share a more similar environment than ordinary siblings, and the author provides some empirical evidence of this. Another methodological criticism seeks to show that heritability estimates are worthless without knowledge of how genes and the environment interact to produce a phenotypic trait. Again, Sesardić provides both a conceptual explanation and empirical data to demonstrate that this is not a valid claim. The argument that high heritability of IQ could be the result of an indirect genetic cause (for example, attractiveness) and the differential treatment stemming from that indirect cause is elegantly dismissed by adducing the fact that this scenario would require extremely high correlations. Moreover, empirical data do not support such a scenario. In the last part of this chapter, Sesardić addresses the "sociological fallacy", i.e. the presumption of causation from a correlation, identifying this fallacy in many environmental accounts.

The fourth chapter, which is called "From Individuals to Groups: Genetics and Race", deals with the controversial issue of differences in IQ among human races. Sesardić outlines the "master argument" against the heritability of such differences, according to which between-group heritability (BGH) cannot be established on the basis of within-group heritability (WGH). This claim was raised by Richard Lewontin in his criticism of Arthur Jensen's work. Sesardić argues that Jensen never committed the fallacy of which Lewontin accuses him, and that there are indeed ways of

proceeding from within-group to between-group heritability. A high WGH can establish non-zero BGH, along with certain empirical information. The between-group difference in IQ between blacks and whites can be explained by the high heritability of within-group differences provided that one has knowledge of certain environmental variables, i.e. whether these environments are the same or nearly the same in both groups, or whether there are any factors which have no within-group variance but are consistently present in one group and absent in the other. Again, the empirical data speak in favor of hereditarianism, since socioeconomic status, educational inequalities and the like have a high variance within both the black and the white population, while the primary suspect for the "missing factor" (i.e. discrimination) can be decomposed into a variety of factors which all have a variance such as that mentioned above. Bearing all this in mind, it is quite surprising how long anti-hereditarians have succeeded in defending their views, not only among the general public but, more importantly, among scientists.

In the fifth chapter, entitled "Genes and Malleability", Sesardić answers the question of whether a genetically determined trait can be (easily) modifiable. One of the most common anti-hereditarian arguments for a positive answer to this question is the phenylketonuria argument. People with this disorder suffer from the inability to metabolize phenylalanine (an amino acid), and the accumulated phenylalanine leads to severe mental retardation. This disorder is 100% genetic in origin, and can be treated by excluding phenylalanine from the diet. Thus, according to anti-hereditarians, a 100% heritable disorder may be overcome by a simple environmental manipulation. By definition, however, something that is 100% heritable cannot be modified! Sesardić cautions that there is a three-step causal sequence in this example: "(1) a gene mutation → (2) inability to metabolize phenylalanine → (3) mental retardation" (p. 159). The environmentally modifiable point is not (2), but (3), since so far no cure for the inability to metabolize phenylalanine has been found, yet there is a way to prevent mental retardation (by eating phenylalanine-free food). In the present conditions, (2) is 100% heritable and (3) is not; therefore, the anti-hereditarian argument loses its strength. 100% heritability does not mean that a trait is non-modifiable forever, but rather only under the present circumstances. Sesardić makes a distinction between "the phenotypic difference that can be eliminated by manipulating environmental influences in the existing range" (p. 164) (i.e. locally modifiable) and differences that can be eliminated by a new environmental influence outside the existing range (i.e. modifiable in principle). A great many misunderstandings may be avoided by bearing this distinction in mind. It is also worth mentioning a few misconceptions about heritability and malleability. Critics have

often pointed out that it is possible to improve a trait throughout the spectrum of its phenotypic value (i.e. its mean) by manipulating the environment. While this is true, Sesardić points out that "the claim was that high heritability of a trait in a given population puts constraints on the malleability of genetically caused *differences* in that trait" (p. 168). Of course, these differences may be smoothed over by putting those with favorable genes in less favorable conditions and those with less favorable genes in more favorable ones. With respect to differences in IQ, this strategy is not without its proponents. Another mistake is to assume the environmental nature of phenotypic variance in a high heritability population under a narrow range of environmental influences, should such variance "shrink" under more favorable conditions.

The sixth and final chapter (not counting the conclusion) is entitled "Science and Sensitivity", and concerns the nature of the relationship between heritability and politics. Sesardić begins by examining two claims: that a scientific idea is mistaken because it is politically motivated, and that a scientific idea is politically motivated because it is mistaken. He does not accept the claim that a scientific hypothesis is false because it has been adopted due to someone's political beliefs. Elliott Sober tried to show that "the genesis of belief *can* sometimes point to the falsity of that belief" (p. 184) where the reason for adopting such a belief has nothing to do with whether it is true. To this Sesardić retorts that "[i]f something is not truth-relevant, then by this very fact it is not falsity-relevant either" (p. 184). Thus a scientific hypothesis is not false because it is politically motivated; nor is it true for that same reason. One cannot reject a scientific hypothesis simply by pointing to the political attitudes of its proponent. Likewise, it is unjust to say that someone has committed a scientific error simply because he has certain political views, since this is difficult to prove. One reason for the hostility towards the heritability viewpoint is a fear of the social consequences it allegedly entails. Philip Kitcher has proposed additional scrutiny for socially dangerous theories. However, this way of thinking leads to an absurd situation where a non-dangerous but false theory is more readily accepted than a dangerous but false one. The central issue of this chapter is whether there is any relation between heritability and politics. Sesardić tries to show that, if the hereditarian hypothesis is true, it has far-reaching consequences for society. For one thing, it would diminish the power of arguments aimed at eliminating racial inequality. The author does not consider racial inequality a morally objectionable fact in itself; rather, whether it is or not depends on the source or origin of such inequality. If its source is biological, then there is no reason to fight against racial inequality. Sesardić also questions the claim that knowledge of group characteristics can tell us little about the character-

istics of a particular individual belonging to that group. By using Bayes' theorem and the contemporary example of terrorism, he demonstrates the obvious fallacy of neglecting group characteristics. The closing argument of this chapter exposes the fallacy committed by Ned Block and Ronald Dworkin when they tried to show that the black mean IQ (85) should be corrected upward. First, Sesardić points out that what is corrected is not the mean itself, but the individual result; it is regression *to* the mean, not *of* the mean. He also demonstrates that blacks cannot be viewed as an IQ 85 group randomly chosen from a higher IQ population, and thus that their individual results should not be corrected upward.

In his conclusion, Sesardić offers an explanation to those readers who may feel that he has presented only hereditarian arguments:

> […M]y task was *not* to offer a comprehensive discussion of the nature-nurture problem […]. I found it interesting to scrutinize very general *methodological* arguments that are often used to short-circuit the debate in the attempt to undermine one of the rival positions, without going into empirical details at all. (p. 229)

His arguments are numerous and subtle, so that presenting them all lies well beyond the scope of this review. Sesardić has made a strong case for the hereditarian point of view. Besides his incisive conceptual analysis, he displays the sensibility of a practicing scientist, a feature which is often absent among philosophers. This book is written in a very clear style that makes it is easy to read, even for non-specialists. *Making Sense of Heritability* will surely become indispensable reading material for all who are actively involved in the nature-nurture debate.

Dario Pavić

Centre for Croatian Studies of the University of Zagreb
Ulica grada Vukovara 68, HR-10000 Zagreb
dpavic@hrstud.hr