

Genetic Essentialism: On the Deceptive Determinism of DNA

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This article introduces the notion of genetic essentialist biases: cognitive biases associated with essentialist thinking that are elicited when people encounter arguments that genes are relevant for a behavior, condition, or social group. Learning about genetic attributions for various human conditions leads to a particular set of thoughts regarding those conditions: they are more likely to be perceived as (a) immutable and determined, (b) having a specific etiology, (c) homogeneous and discrete, and (d) natural, which can lead to the naturalistic fallacy. There are rare cases of “strong genetic explanation” when such responses to genetic attributions may be appropriate; however, people tend to overweigh genetic attributions compared with competing attributions even in cases of “weak genetic explanation,” which are far more common. The authors reviewed research on people’s understanding of race, gender, sexual orientation, criminality, mental illness, and obesity through a genetic essentialism lens, highlighting attitudinal, cognitive, and behavioral changes that stem from consideration of genetic attributions as bases of these categories. Scientific and media portrayals of genetic discoveries are discussed with respect to genetic essentialism, as is the role that genetic essentialism has played (and continues to play) in various public policies, legislation, scientific endeavors, and ideological movements in recent history. Last, moderating factors and interventions to reduce the magnitude of genetic essentialism, which identify promising directions to explore in order to reduce these biases, are discussed.

Keywords: psychological essentialism, genetic attributions, stereotypes, naturalistic fallacy, scientific communication

Genes can explain almost everything about us, or so it seems. People inherit genes associated with their physical characteristics and also their political attitudes, religiosity, personality traits, vocational interests, and specific phobias (see Bouchard, 2004, for a review). Further, an analysis of our DNA can inform us, with a certain degree of precision, where some of our ancestors originated, and the probability that we will develop various diseases. These are all fascinating research findings and it is an encouraging reflection of people’s scientific curiosity that the media enthusiastically reports on these kinds of discoveries. It can indeed be captivating to learn of the materialistic building blocks inside us that seemingly make us who we are.

But how does this knowledge about our genetic foundation affect us? This article explores how people make sense of and respond to the discourse regarding the roles of genes in human nature and experience. While extensive legal, philosophical, and sociological research has been directed towards the study of the

individual and social implications of hereditary research (e.g., Conrad, 1997; de Melo-Martin, 2005; Morse, 1998; Nelkin & Lindee, 1995), our purpose of this article is to assess the psychological effects of considering a genetic foundation of human nature. We propose that people’s understanding of genetics with relation to life outcomes is shaped by their psychological essentialist biases—a process termed *genetic essentialism*—and this leads to particular consequences when people consider the relations between genes and human outcomes. At the same time, we argue that this genetic essentialist tendency is, in turn, reinforced by the representations of genes in public discourses. We suggest that people are influenced by scientific arguments regarding the role of genes in their lives in some profound ways that are distinct from learning about other kinds of scientific arguments. Not only do people’s genes influence their behavior in the many intriguing ways documented by behavioral geneticists, but people’s understanding of genes also influences the ways that they live their lives.

In the following sections, we elaborate on people’s psychological essentialist biases and discuss the notion of genetic essentialism, that is, how encounters with information about genes prompt people to think in essentialist ways. We then discuss how considerations of genetic attributions for human conditions can exacerbate stereotyping and affect the ways that people think and act regarding race, gender, sexual orientation, criminality, mental illness, and obesity. Following this discussion, we address the role that people’s genetic essentialist biases have played in eugenic ideologies and policies and how these biases shape and are in turn shaped by contemporary discussions of genetic research. Finally, we consider moderators and potential interventions designed to mitigate some of the harmful consequences of genetic essentialism.

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Psychological Essentialism

People tend to “essentialize” certain entities that they encounter. They perceive “natural” categories such as chemicals, minerals, and especially living organisms as having an underlying, nontrivial, fundamental nature that makes them what they are (e.g., Atran, 1987; Gelman, 2003; Hirschfeld & Gelman, 1994; Medin & Ortony, 1989). People demonstrate psychological essentialism when they perceive an elementary nature or essence, which is underlying, deep, and unobserved, that causes natural entities to be what they are by generating the apparent shared characteristics of the members of a particular category. For example, a cat’s underlying essence causes it to have whiskers, soft fur, sharp claws, and the tendency to purr when satisfied. Essence constrains visible characteristics but is not defined by them. There may be changes in the observable characteristics of members of a category (e.g., hairless cats), but these do not necessarily imply changes in the essence of these members (Medin & Ortony, 1989).

While pure essentialism has been dismissed as metaphysically problematic (see Medin & Ortony, 1989, for a lucid explanation), psychological essentialism reflects how people routinely think about and categorize members of groups (Gelman, 2009). As a cognitive heuristic, psychological essentialism facilitates, and at times determines, the formation of categories.

Psychological essentialism overlaps to a degree with a number of other psychological tendencies, including the correspondence bias (Gilbert & Malone, 1995), entity theories of self (Dweck & Leggett, 1988), and entitativity (Campbell, 1958). These tendencies are similar in that they involve people perceiving and understanding others in terms of an invisible stable essence. Psychological essentialism is a general human tendency, and evidence for it has been found among children and adults in an array of diverse cultures including impoverished neighborhoods in Brazil (Sousa, Atran, & Medin, 2002), pastoral herders in Mongolia (Gil-White, 2001), Vevo children in Madagascar (Astuti, Solomon, & Carey, 2004), Menominee community members in Wisconsin (Waxman, Medin, & Ross, 2007), and middle-class children and adults in the United States (Gelman, 2003). The evidence for psychological essentialism is broad enough that the construct is a good candidate for a functional human universal, although cultures may vary in the degree to which these essentialist biases are present (see Norenzayan & Heine, 2005).

The causal relationship between essence and expected characteristics is one of the defining elements of essence. Another defining element of an essence is stability. The essence of a cat is presumed to be immutable: it does not change even when observable traits are transformed because of direct physical or environmental alterations, such as being shaved or surgically altered (Gelman & Wellman, 1991; Keil, 1989; Rips, 1989).

The essence of a natural-kind category suggests that the members of that category are perceived as homogeneous and discrete—there is something, for example, that makes all cats recognizable as cats and distinct from other animals. The unique, unobserved essence of each category affords the perceiver inductive potential, which allows one to make specific physiological and behavioral inferences regarding the members of a particular category (Haslam, Bastian, Bain, & Kashima, 2006).

People do not rely on essences just to understand the nature of species; they also make essentialist judgments when they seek to

understand the behavior of social groups. Rothbart and Taylor (1992) argued that socially constructed groups such as race and gender, while better characterized as human artifacts, are essentialized in the same manner as natural kinds. Use of this heuristic is evident among Mongolian tribal groups—members of these groups perceive tribal “ethnies” to have different innate capabilities that they believe persist even among people who had been adopted at birth and raised by members of other groups (Gil-White, 2001).

Essentializing social groups increases the perceived homogeneity and immutability of the members of a group and influences how people make inferences about group members. Such essentializing is associated with increased stereotypical thinking and attitudes (e.g., Haslam et al., 2006; Haslam, Rothschild, & Ernst, 2000, 2004; Hong, Levy, & Chiu, 2001).

Although the essence of any category is unobserved, it is presumed to influence a variety of known and yet-to-be-discovered characteristics. Medin and Ortony (1989) argued that the unobservable and indescribable nature of the essence does not undermine the use of such a construct. Rather, people use an “essence placeholder” (Medin and Ortony, 1989, pp. 184–185) to overcome the abstractness of the essence. This placeholder allows people to draw causal inferences from the essence to observed characteristics without needing to give the essence a materialistic description, which would ultimately limit it and may preclude yet-to-be-known essentialist category-based inferences. We contend that “genes” (or at least the way that most laypeople conceive of genes) often serves as the placeholder for this imagined essence, and this has important implications regarding how individuals respond when they encounter genetic information about people.

Genetic Essentialism

An important component of psychological essentialism has been the idea of *innate potential* (Atran, 1987; Rothbart & Taylor, 1992). When we consider the category of a species, membership imposes certain constraints on the characteristics of the particular species’ members because the essence of category membership is passed down through biological lineage. To a certain extent, this notion of innate potential is also perceived to exist for some social groups (e.g., Jayaratne et al., 2006, 2009; Phelan, 2005). The relationship between an immutable essence and innateness on the one hand and innateness and genes on the other suggests that the observable characteristics of a group are assumed to be based on a shared genetic foundation.

The defining elements of psychological essentialism (i.e., immutable, fundamental, homogeneous, discrete, natural) are similar to the common lay perception of genes. Such similarity suggests that members who are assumed to share a distinct genetic makeup are also assumed to share their essence. People’s understanding of genes may thus serve as an essence placeholder, allowing people to infer their own and others’ abilities and tendencies on the basis of assumed shared genes. The tendency to infer a person’s characteristics and behaviors from his or her perceived genetic makeup is termed *genetic essentialism*. As Nelkin and Lindee (1995) put it, “genetic essentialism reduces the self to a molecular entity, equating human beings, in all their social, historical, and moral complexity, with their genes” (p. 2).

We argue that once people consider the existence of a genetic foundation to a particular life outcome, psychological tendency, or characteristic, their psychological essentialist biases are activated, and a particular set of associated thoughts about those outcomes are likely to emerge. First, genetic essentialism may lead people to view outcomes as *immutable* and *determined*. That is, an outcome is perceived to unfold according to some fixed set of underlying genetic processes that people assume is largely independent of environmental influence and beyond individuals' control. Genetic essentialism thus leads people to view genetically influenced outcomes as inescapable and predestined. If the genes are present, the outcome is expected.

Second, arguments for a genetic foundation for a human condition may lead people to view the relevant genes as entailing the fundamental cause of the condition—what Meehl (1977) referred to as a *specific etiology*. The genetic foundation and the associated condition may be viewed as having two-way pathogenicity in that the presence of the hypothesized genes is seen to prove the presence of the condition, and, likewise, the absence of the genes is seen to exclude the condition. Perception of the genetic foundation as a fundamental cause leads people to devalue the role of ontogenetic, environmental, or experiential factors.

A third consequence of genetic essentialism is that it may lead people to view groups that share a genetic foundation as being *homogeneous* and *discrete*. The relevant condition may be perceived as coterminous with the boundaries of its associated group—all members of a group that share the genetic essence have the potential to possess the associated condition, and that condition should not be observed in those who do not share the underlying genetic foundation.

Finally, genetic causes lead people to view the outcome as *natural*, and, in some domains, this may prompt the naturalistic fallacy such that the associated outcomes are perceived as more morally acceptable. The naturalistic fallacy refers to the tendency to derive ethical properties (e.g., being “good” or “right”) from natural properties (e.g., being “tall,” or being “green”; Frankena, 1939; Moore, 1903), that is, a particular tendency, which is judged to be natural, will be viewed as more acceptable than one that is deemed unnatural. Furthermore, something may be more likely to be identified as natural to the extent that its existence is perceived to be predicated upon an underlying genetic predisposition (unless the genes themselves are the product of artificial manipulation as in the case of genetically-modified products). For example, homosexuality may be viewed more positively if it is perceived to be the outcome of a natural, genetic predisposition rather than as a consciously made life choice. However, because the naturalistic fallacy involves deriving a moral “ought” from a natural “is,” it most prominently emerges when the outcomes are associated with behaviors that trigger volitional considerations, such as evaluations of criminal behaviors or lifestyles associated with obesity. The naturalistic fallacy is less likely to be activated, in contrast, in the consideration of categories not perceived to be associated with any volitional control (e.g., race, gender, height). Because, for the most part, people do not tend to think of someone “choosing” to be born African American, female, or tall, they are unlikely to consider these attributes as having any moral implications.

These four ways of thinking associated with genetic essentialism increase in frequency when people encounter genetic arguments serving as prisms through which people view the associated

outcomes, and thus distort their understanding of them. Once people's genetic essentialist biases have been activated, people come to view the relevant condition or outcome in different ways than if they had not considered an associated genetic foundation.

Is Genetic Essentialism Irrational?

We submit that genetic essentialism reflects a biased, and frequently undesirable, response to encounters with genetic information, which we will describe in more detail in following sections. However, one might question whether such responses to genetic information may instead be considered rational. Perhaps knowing about an underlying genetic foundation for a condition should reasonably make one conclude that the condition is determined, of a specific etiology, homogeneous, and natural. For example, if an individual has a series of a sufficient number of repeating sequences of three bases—CAG—in the right position at the end of Chromosome 4, that person will develop Huntington's disease if he or she does not die prematurely of another cause. Further, the onset of the symptoms of the disease can even be predicted on the basis of the number of repeating sequences that exist (Zoghbi & Orr, 2000). By all accounts, Huntington's disease is determined, has a specific etiology, is homogeneous, and is natural. Thinking about Huntington's disease in these fatalistic ways is arguably the correct way to understand it.

However, genes influence phenotypes in different ways. On the one hand, genes can influence phenotypes through major biochemical pathways that can be measured and understood, which Turkheimer (1998) referred to as “strong genetic explanations” (p. 786). This is the case with monogenic diseases and conditions that involve a small number of genes. Coming to think about them as more determined, solely caused, homogeneous, and natural as a result of learning about their underlying genetic foundation would indeed appear to be a rational response.

On the other hand, strong genetic explanation appears to be more of the exception than the rule. Monogenic diseases represent only about 2% of genetic-based diseases (Jablonka & Lamb, 2006); the norm is that multiple genes are involved, which is further complicated in that the same allele can be expressed differently depending on environmental contingencies (e.g., Caspi et al., 2002; Guo, Tong, & Cai, 2008). In summarizing the evidence for predicting disease risk on the basis of genes, Kraft and Hunter (2009) stated that “many, rather than few, variant risk alleles are responsible for the majority of the inherited risk of each common disease” (p. 1702). Genotype-phenotype relationships can be highly complex, where phenotypes emerge as the result of the interaction of many genes when particular environmental conditions are met and where genes may influence which environments an individual is more likely to seek out and subsequently be influenced by. Such complex relations defy a genetic essentialist response.

Turkheimer (1998) uses the expression “weak genetic explanation” (p. 786) to refer to those cases in which a condition is known to have a genetic basis (i.e., heritability > 0), yet the mechanisms that transmit it are largely unknown or are unknowable. Much of the ways that genes relate to human conditions can be described as weak genetic explanations. Almost all human behaviors are heritable (Turkheimer, 2000), including voting behavior (Fowler, Baker, & Dawes, 2008), cigarette smoking (Kendler, Thornton, &

Pedersen, 2000), and divorce (Jocklin, McGue, & Lykken, 1996), although the genetic pathways underlying these are not tractable. Essentialist responses to genetic explanations for these cases are not rational—the more tenuous the link between genes and conditions, the more irrational is an essentialist response.

That genes most commonly influence phenotypes by way of weak explanations (i.e., by altering risk assessments, modifying susceptibilities, changing probabilities) underscores that essentialist responses to genetic associations may often be inappropriate. However, as Hinshaw and Stier (2008) argued in their account of stigma and mental illnesses, when people consider genetic attributions for a condition, they frequently fail to take into account other perspectives, such as how the person with that condition fits with the environment or how that person's development has influenced the genesis of the condition. That is, the genetic attributions frequently get prioritized above other kinds of attributions for the phenomena. These complexities exist for most human phenomena in which nature and nurture interact. Because these complexities are more difficult to communicate and understand, it is often the case that for many people, all genetic explanations tend to be interpreted as strong genetic explanations.

In sum, we submit that when people's genetic essentialist biases have been activated, they tend to view the associated phenomena as more immutable, homogeneous, natural, and caused by relevant genetic factors than an objective analysis would suggest is appropriate. These biases lead people to attend more to the genetic causes of the phenomena at the expense of environmental, experiential, or gene–environment interactional causes. To be clear, we are not suggesting that phenomena with weak genetic explanations mean that genes are irrelevant, that the environment is the sole cause of the phenomena, or that people would fare best by viewing these phenomena as solely the product of people's choices. Rather, we are arguing that genetic essentialist biases lead people to weigh the genetic contributions to relevant phenomena more than is justified.

Lay Understandings of Genetics

Compounding the difficulties of reasoning sensibly about genetic explanations is the fact that, for the most part, people have rather limited knowledge regarding genetics (e.g., over half of the surveyed population did not know that genes are located in cells; Lanie et al., 2004). A limited understanding of genes, however, does not prevent people from offering spontaneous genetic explanations for the behavior of others. A number of studies document how readily individuals turn to genetic explanations in making sense of people's behaviors (e.g., Parrott et al., 2005; Shostak, Freese, Link, & Phelan, 2009; Singer, Corning, & Lamias, 1998). This is also true among children, who have been found to explicitly evoke genes to explain others' behaviors despite having little understanding of genetics (e.g., Heyman & Gelman, 2000).

Although most individuals have a rather limited understanding of genetics, people encounter scientific arguments and empirical discoveries about genetics that are commonly discussed in the media (perhaps more commonly than discoveries in many other fields of science). Arguably, many people receive most of their current knowledge of genetics directly or indirectly from the popular media (Conrad, 1997). However, the media often present simplified accounts of genetics research in ways that suggest

strong genetic explanations and that resonate with the typical layperson's intuitive, and often incorrect, understanding about how genes operate (Conrad, 1999; cf. Bubela & Caulfield, 2004). For example, Alper and Beckwith (1993) have noted that public discourse on genetics is plagued by genetic fatalism in such a way that any association between genes and behavior is seen to imply predetermined, immutable behavior (we will return to this point in a later section).

We maintain that people frequently think about genetic accounts for human outcomes in oversimplified ways (viz., as determined, having a specific etiology, homogeneous, discrete, and natural), which affect how they understand other people as well as themselves. In the following section, we examine the role of genetic attributions in the evaluation of members of socially-constructed groups. We discuss how genetic essentialist biases are at times conducive to stereotyping and discrimination and how these biases may play a role in shaping people's understanding about race, gender, sexual orientation, criminality, mental illness, and obesity.

Genetic Attributions and Perceptions of Socially Constructed Categories

As previously noted, much research reveals that people demonstrate psychological essentialism when they evaluate social groups (e.g., Gil-White, 2001; Haslam et al., 2006; Rothbart & Taylor, 1992). These essentialist biases appear to be exacerbated when people perceive groups as sharing a common genetic makeup, providing fertile ground for the growth of stereotyping and prejudice. For many different kinds of groups, people view group members as sharing innate, immutable, and group-defining features that cause their distinctive behaviors and characteristics, some of which are perceived to be genetic in origin (e.g., Allport, 1954).

The relation between genetic attributions and stereotypes is evident in that the Biological Basis (of Essentialism) Scale (example item: "The kind of person someone is can be largely attributed to [his or her] genetic inheritance") correlates positively with the degree to which people endorsed a variety of stereotypes regarding different social groups (Bastian & Haslam, 2006). Moreover, it correlated more strongly with stereotypic tendencies than did a number of other relevant measures, such as right-wing authoritarianism (Altemeyer, 1988), social-dominance orientation (Pratto, Sidanius, Stallworth, & Malle, 1994), and a measure of an entity theory of self (Levy, Stroessner, & Dweck, 1998). That is, a tendency to explain behavior in biological terms is one of the stronger predictors of stereotyping. Likewise, the Belief in Genetic Determinism Scale, which includes items such as "The fate of each person lies in his or her genes," positively correlates with prejudice, negative racial stereotyping, nationalism, and patriotism (Keller, 2005). In sum, people who are especially likely to view groups as sharing a common genetic essence are more likely to espouse stereotypic beliefs about those groups.

That genes play an important role in stereotyping has broad implications for the ways that people make sense of various social groups. In the following sections, we summarize a number of studies in which investigators explored the ways that people perceive and respond to proposed correlations between genes for specific conditions and certain social groups.

Genetic Essentialism and Race and Ethnicity

Race and, perhaps to a lesser extent, ethnicity are two of the most relied-upon social categories. There is no shortage of evidence that individuals assign a tremendous amount of importance to people's race and ethnicity. Researchers in psychology have examined the role of these constructs in relation to a wide array of phenomena, such as stereotypes, prejudice, ingroup and outgroup perceptions, identity, and associated abilities and cognitive mechanisms (for reviews see Dovidio, Hewstone, Glick, & Esses, in press; Yzerbyt & Demoulin, 2010). Across many areas of study, race and ethnicity remain contentious topics.

In Gordon Allport's (1954) portrait of the prejudiced personality, he noted the peculiar power that a belief in essence had in sustaining people's racial prejudiced views. "There is an inherent 'Jewishness' in every Jew. The 'soul of the Oriental,' 'Negro blood,' Hitler's 'Aryanism,' 'the peculiar genius of America,' 'the logical Frenchman,' 'the passionate Latin'—all represent a belief in essence. A mysterious mana (for good or ill) resides in a group, all of its members partaking thereof" (p. 174). We argue that people often conceive of genes as underlying this "mana" and this fosters an array of (mostly undesirable) reactions.

Whether there is a genetic basis to race is a question that has been subjected to intensive scientific scrutiny (e.g., Cavalli-Sforza, Menozzi, & Piazza, 1994; King & Motulsky, 2002; Rosenberg et al., 2002). Although the majority of the scientific community and international political bodies assert that there is no biological basis for the concept of race in the sense that within-race variability is far more pronounced than between-race variability (e.g., Anderson & Nickerson, 2005; Lewontin, Rose, & Kamin, 1984; United Nations Educational, Scientific and Cultural Organization, 1970), people still use race as a biological marker for making inferences (e.g., Dienstbier, 1972; Gil-White, 2001). People's use of genetically inspired racial categorizations resembles the use of species-based categorizations (Rothbart & Taylor, 1992) in that it binds individuals into discrete, natural, immutable, and necessary categories (Haslam et al. 2000). This essentialist perception of race has been related to the perceived genetic similarities among members of such groups (Haslam et al., 2006).

In recent research, investigators have examined the effects of genetic attributions for perceived racial and ethnic differences and how beliefs about genetic differences among races are associated with prejudice and discrimination. For example, Jayaratne and colleagues (2006, 2009) investigated the race-related genetic attributions of White Americans. They assessed genetic attributions for racial differences by measuring how much people endorsed the role of genes in constructing racial differences in intelligence, a drive for success, and violence. They found that people who made more genetic attributions also tended to score higher on both measures of traditional racism (e.g., a negative reaction of a White parent to their child's marrying a Black partner) and modern racism (e.g., a belief that Blacks have themselves to blame for not doing well), even after controlling for various demographic and attitudinal variables.

In another investigation, No et al. (2008) studied the relations between different theories of race and attitudes toward White Americans among Asian-Americans. They found that Asian Americans who held biologically based race beliefs perceived greater differences in the personality characteristics of White and Asian

Americans. Furthermore, Chao, Chen, Roisman, and Hong (2007) found that among bicultural Asian Americans, holding biological essentialist beliefs about race was associated with an increased difficulty in switching between Asian and American cultural frames; apparently a biological perspective on race makes it challenging to identify with more than one culture. Furthermore, those who subscribed to a biological race theory showed stronger stress reactions while talking about their bicultural experiences than those with socially based race beliefs. These findings converge to suggest that those who hold a biological theory of race have more difficulty integrating bicultural experiences.

While such findings indicate an association between genetic attributions for racial differences and racial attitudes, only limited conclusions can be drawn due to their correlational nature. To explore whether encounters with genetic arguments about differences between groups lead to an increase in prejudice requires experimental studies in which genetic attributions are manipulated. To date, only a few such studies have been conducted. In one study, German students read either an essay about the geography of human genetic diversity or an essay with a neutral theme (Keller, 2005). The genetic essay led participants to show a stronger ingroup bias (increased their liking of Western Europeans and decreased their liking of Eastern Europeans), compared with the neutral essay. This effect was moderated by people's beliefs in genetic determinism, revealing a stronger effect for the prime among people with high scores on the scale.

Likewise, in another study, Asian American participants read essays arguing for either a biological race theory or a social race theory (No et al., 2008). Those who read the biological race theory were more likely to disidentify with American culture than those who read the social race theory. Likewise, whereas those who read the social race theory identified with their ethnicity just as strongly as they identified with American culture, those who read the biological theory identified more strongly with their ethnicity than they did with mainstream American culture. It is important to note here that the social race theory did not have the same impact as the biological theory—only biological information led to these essentialist responses.

Along similar lines, participants in another study read either an essay that argued for a biological basis of race, an essay that argued for a social basis of race, or an unrelated control essay (Williams & Eberhardt, 2008). They then saw a video of a student who was being fired from a job and were asked how much they would like to be friends with the student. Those who read the biological account of race were less interested in becoming friends with the student than those in the other conditions, provided that the student was from a race different than their own. In contrast, there were no effects for the primes if the student was the same race as the participant. Hence, participants in this study did not appear to have had an essentialized view of race unless they encountered the biological theory, and this led them to have more negative views of an outgroup target.

Using another experimental approach, Condit, Parrot, Bates, Bevan, and Acher (2004) showed that adding the topic of race to a discussion of genes and cardiac disease led people to show increased evidence of racism and genetic discrimination. This study has broad implications, given the rise of attempts by medical researchers to tailor race-appropriate cures for common illnesses (e.g., Alper & Beckwith, 1999, 2002; Resnick, 1999).

These studies show that genetic arguments for race lead people to view themselves as more distinct from those of other races (i.e., race becomes a more homogeneous and discrete category) and increase unwarranted responses. In light of existing projects that may reveal genetic differences among different ethnic populations, the moderating variables that contribute to the relationship between genetic attributions and bigotry (such as beliefs in genetic determinism; Keller, 2005) offer an important potential source for future scientific studies. Indeed, such research would be a welcome addition, as it might facilitate interventions designed to inoculate people against the increased bigotry that seems to follow race-based genetic attributions. We return to this important point later.

One of the most contentious issues underlying discussions about race has been whether there is a genetic basis for racial differences in intelligence. Perhaps more than any other psychological construct, intelligence has been framed in strong essentialist terms. One of the early researchers on intelligence, Sir Cyril Burt (1934, p. 28), defined intelligence as “inborn, all-around intellectual ability . . . inherited, not due to teaching or training . . . uninfluenced by industry or zeal (that) enters into all we do or say or think.” Intelligence in adults is heritable to a substantial degree, with the heritability typically estimated to range from .50 to .85 (Bouchard, 2004; but note these estimates may be inflated because of a restricted range in environments; Turkheimer, Haley, Waldron, D’Onofrio, & Gottesman, 2003).

An emphasis on the heritable basis of intelligence was evident in the initial development of intellectual testing, and indeed, such testing was a critical component of the eugenics movement in the early twentieth century (Kevles, 1985). For example, the fact that American Blacks have been found to score lower than American Whites on IQ tests has been interpreted by some researchers as indicating that there was little hope in being able to improve the academic performance among Blacks (e.g., Herrnstein & Murray, 1994; Jensen, 1969; for critiques of this work, see Flynn, 2007; Gould, 1996; Nisbett, 2009). More recently, James Watson, a Nobel Prize laureate for the discovery of the double helix structure of the DNA, offered in an interview for the London *Sunday Times* that he was “inherently gloomy about the prospect of Africa, since “all of our social policies are based on the fact that their intelligence is the same as ours—whereas all the testing says not really” (Nugent, 2007). That is, the heritable component of intelligence has often been interpreted as showing that the intellectual potential of people and entire races of people lays beyond the reach of any environmental or educational influence.

There are two key fallacies in these conclusions, and both reflect the somewhat irresistible power of genetic essentialism. The first is the notion that heritability estimates calculated within groups demonstrate that between-group differences are due to the postulated genes underlying the heritability. That is, the genes underlying heritable traits are assumed to be the sole factor (i.e., they represent a specific etiology) underlying both individual- and group-variability in the phenotype (see Plomin, DeFries, McClearn, & McGuffin, 2008). Demonstrating the appeal of this fallacy, research finds that people who use genetic explanations for individual differences are also more likely to use genes to explain perceived group differences for that same trait (Sternthal, Jayaratne, & Feldbaum, 2009).

The second fallacy is that the heritability of a trait indicates that the trait cannot be modified by environmental elements—that is, a phenotype is viewed as a predetermined and immutable outcome of the underlying (but unidentified) genotype. But, of course, the heritability of any trait says nothing about its modifiability. That heritability is frequently interpreted in these erroneous ways (and for many factors in addition to race and intelligence), even by some behavioral geneticists and intelligence researchers, underscores how such arguments resonate with people’s essentialist biases. People often view intelligence in essentialist terms, believing that it is the immutable product of a fundamental cause (the genotype) that is coterminous with the individual’s race. Once these essentialist biases are prompted, people focus their attention almost exclusively on the perceived underlying genetic foundation and thereby disempower environmental influences on intelligence.

Genetic Essentialism and Gender

While sex is genetically determined, gender is a social construct that spawns both biological elements, such as sexual organs, and social elements, such as appropriate social roles. Gender is probably the most essentialized social category (e.g., Gelman & Taylor, 2000; Prentice & Miller, 2006)—Indeed, in an investigation of 40 different social categories, gender was the most likely to be perceived in the same manner as natural kinds (Haslam et al., 2000). Children as young as 4 years old use gender as an inference-rich category that enables them to draw conclusions regarding human behaviors, even when it contradicts other categorization cues such as appearance (Gelman, Collman, & Maccoby, 1986) and environment (Taylor, 1996). Thus, when essentialized thoughts of gender come to mind, people are more likely to view gender characteristics as innate, immutable, deriving from a single etiology, and nonoverlapping.

A number of correlational studies have demonstrated that genetic essentialist views of gender are associated with heightened perceptions of sex differences. For example, a belief in genetic determinism moderately correlates with modern sexism (Keller, 2005). Likewise, women who more strongly endorse a biological gender theory (compared with a social gender theory) also tend to endorse feminine traits (Coleman & Hong, 2008). It seems that the more one views gender differences as an outcome of genetic causes, the more one views the sexes as homogeneous categories.

Experimental research has shown that essentialist views of gender can have a causal influence on stereotyping. For example, in one study, participants read one of two fictitious newspaper articles in which the ability to identify plants was reported to vary according to gender; one of the articles provided a genetic explanation for this difference, whereas the other provided a sociocultural account (Brescoll & LaFrance, 2004). Those who read a genetic explanation for the gender differences were more likely to believe that a person cannot change and more strongly endorsed gender stereotypes (i.e., attributing more stereotypical masculine traits to the average man and more feminine traits to the average woman), compared with those who had learned of a sociocultural explanation. This research underscores how genetic essentialist views can lead to specific etiological beliefs: If genes underlie one aspect of sex differences (i.e., plant identification), they are also viewed as a key cause for other feminine and masculine traits.

Dar-Nimrod and Heine (2006) explored how genetic attributions regarding male superiority in math affect women's math performance. A number of scientific claims suggest that there are potential genetic underpinnings for the alleged gender disparity in math performance (e.g., Benbow & Stanley, 1980). Most famous of these, in 2005, Lawrence Summers (2005), then the president of Harvard University, suggested that a larger percentage of men have intrinsic mathematical aptitude than did women. How might exposure to differing accounts for perceived sex differences in math aptitude affect women's math performance? Using the framework of "stereotype threat" (Steele & Aronson, 1995), in which members of stereotyped groups perform worse on stereotyped tasks when their group membership is made salient, investigators exposed female participants to one of four manipulations: (a) a claim that there are no sex differences in math performance; (b) a reminder of their sex; (c) a claim that sex differences in math have a genetic basis (specifically, participants learned of the false information that men outperform women by 5%); and (d) a claim that sex differences in math (again, a 5% difference) have an experiential basis. The results indicated that, consistent with past work on stereotype threat, reminders of women's sex led them to do worse on the subsequent math test compared with those who learned that there were no sex differences in math. Of particular interest, those women who learned of the genetic argument performed as poorly on the math test as those women who thought about their femininity. This suggests that women's default understanding of the stereotype of female underperformance in math is consistent with a perception of a relevant genetic difference between men and women. In contrast, those women who learned of an experiential account for sex differences in math performance showed no evidence for stereotype threat (also see Eccles & Jacobs, 1986). These findings suggest that natural inclinations toward genetic essentialist views of gender can be overridden in some situations by explicit experiential explanations.

Similarly, in another study, female participants read an article arguing either for a biological gender theory or a social gender theory (Coleman & Hong, 2008). Those who read the biological theory endorsed traditional feminine attributes (such as shy, feminine, soft-spoken) more strongly than those who read the social theory. Moreover, participants in the biological condition were quicker to endorse feminine traits than were those in the social condition.

In sum, there is much evidence that people tend to perceive a variety of kinds of gender differences in genetically essentialized terms. In some situations, people's default theories regarding gender differences appear to be essentialist; specifically, they view gender differences as determined, with a specific etiology, indicating homogeneous categories, and natural. Research, which demonstrates that highlighting environmental attributions for gender differences can reduce certain stereotypic tendencies and undesirable behaviors, suggests one possible way to combat genetic essentialism.

While race and gender represent social categories in which one's membership is established at birth and remains largely uncontested and immutable (with some important exceptions, such as transgendered people), we examine in the following sections social categories that are not evident at birth. In some cases, such as sexual orientation, criminality, and obesity, there are associated behavioral manifestations that introduce volition as a competing

attribution. In other cases, such as with respect to mental illnesses, there exists a potential that individuals may find themselves in the category at a later point in life, for example, by developing schizophrenia. Race and gender differ from these other categories in that the individuals are less likely to be perceived as an active agent in becoming a member of their respective categories. The role of perceived agency is clearly affected by genetic essentialist biases as we describe.

Genetic Essentialism and Sexual Orientation

One social category has long been linked with genetics: sexual orientation. We discuss this at some length here as it is an example of how a political debate can hinge on the postulated existence of relevant genes. During the 19th century, a number of scientists, among them K. M. Benkart and Paul Moreau, suggested that sexual orientation was heritable (see Bullough, 1976; Conrad, 1997). The idea that homosexuality has genetic origins was much discussed throughout the twentieth century and gained further scientific credibility when Hamer, Hu, Magnuson, Hu, and Patatucci (1993) claimed to have identified a genetic marker (Xq28) that partly accounted for male homosexuality. Hamer et al.'s research attracted much media attention and the marker (which includes hundred of genes) soon became known as the "gay gene" (although repeated attempts to replicate Hamer et al.'s findings in other labs have all failed; Rice, Anderson, Risch, & Ebers, 1999).

The public reaction to the discovery of Xq28 provides a case study of genetic essentialism. Dozens of news articles followed the publication of the discovery, igniting a discussion of the ramifications. Although the research article was carefully framed as the initial finding of a genetic marker that may contain genes that are involved in homosexual orientation for men, many of the media articles highlighted how this finding indicated that people have a lack of choice in adopting a homosexual lifestyle. Other articles focused on eugenic concerns such as selective abortions for "suspect" fetuses as well as diagnostic tests designed to identify such fetuses (for a review, see Conrad & Markens, 2001). Both reactions underscore how an immutable causal relationship between genes and homosexuality was perceived. The same kind of essentialist reactions did not follow, for example, the psychoanalytic proposition that overbearing mothers and detached, cold fathers may be responsible for homosexual tendencies (e.g., Isay, 1989), although infants' conscious control over these kinds of parental behaviors is arguably no greater than their control over their genes. Again, this is evidence that genetic arguments lead to qualitatively different reactions than environmental ones.

How does a perceived relationship between genes and sexual orientation affect people's attitudes towards homosexuals? Bailey and Pillard (1991) hypothesized that if homosexuality was shown to have a genetic basis, then discrimination against homosexuals would drop. Several investigators exploring this hypothesis have found that an increase in the perception that genes play a causal role in sexual orientation predicts a decrease in prejudice toward homosexuals, even after controlling for relevant constructs such as religiosity and political orientation (Jayaratne et al., 2006; cf. Horvath & Ryan 2003; Landén & Innala, 2002; Sakalli, 2002). This hypothesis was further explored by Haslam and Levy (2006) who investigated the structure of essentialist beliefs about homosexuality. They found biological and perceived discreteness fac-

tors; the biological factor was a predictor of positive attitudes toward gays, while the discreteness factor was a negative predictor, even above and beyond conservative attitudes and authoritarianism. In sum, a perceived genetic basis of homosexuality appears to lead to more positive evaluations of gays (but see Boysen & Vogel, 2007).

This relation between a perceived genetic foundation and tolerance toward homosexuals demonstrates how genetic essentialism can lead to the naturalistic fallacy in some domains. In a political climate in which some people still believe that homosexuals are “choosing” an “immoral” lifestyle, learning of a genetic foundation to sexual orientation not only leads people to view sexual orientation as discrete and determined by a specific etiology, but it also reduces prejudice against homosexuals. Apparently, behaviors with moral implications lose their moral force if people view those behaviors as beyond the individual’s volition. In contrast, although the previously described review also showed how people viewed ethnicity and gender in genetic essentialist ways, there was no evidence for more positive views of different ethnicities and genders when genes were considered, as the questions of whether one is a woman or Asian lie outside of volitional control.

In addition to the naturalistic fallacy, judgments of homosexuals may be influenced by the perceived immutability that is associated with genetic-essentialist responses. Weiner, Perry, and Magnusson (1988) argued that once a stigmatized condition is associated with a somatic condition (e.g., a genetic predisposition), people come to view that condition as uncontrollable, and this can lead to enhanced feelings of sympathy for members of the category. Weiner et al. posited that sympathy in this connotation leads to diminished condemnation and reprimand. Hence, unlike the cases of race and sex, where there is no volitional element associated with membership, genetic attributions of homosexuality can lead to more positive evaluations than other kinds of attributions.

That genetic arguments can reduce negative evaluations in some domains is a potentially positive feature of genetic essentialism; however, one should keep in mind that political contexts are dynamic. Given potential scientific advances (e.g. identification of genetic markers that may relate to homosexuality) or a change in political climate, the association that currently acts as a positive moderator of prejudice toward homosexuals could one day be used as grounds for eugenic practices (Brookey, 2002; Hegarty, 2002).

Genetic Essentialism and Criminality

A perceived link between genes and criminality has been noted in many famous criminal cases and stood as a major pillar of the eugenics movement in the first half of the twentieth century (see Galton, 1883; Goddard, 1913; Kevles, 1985). Since that time, arguments for the genetic origins of criminality continue to have persuasive power. In 1965, Jacobs, Brunton, Melville, Brittan, and McClement (1965) published a study in which they theorized that criminal behaviors might be related to a chromosomal abnormality; this claim led to widespread news coverage. Jacobs et al. identified a disproportionate number of males with an extra Y chromosome (XYY) among the population of a correctional facility in Scotland and suggested that this anomaly “predisposes its carriers to unusually aggressive behavior” (p. 1351). Public interest soared, and debates ensued over questions of culpability and choice for such “carriers” (Nelkin & Lindee, 1995). Soon after,

researchers came to largely dismiss the notion that the extra Y chromosome is associated with aggression, emphasizing methodological flaws and biased inferences in Jacobs et al.’s (1965) study (e.g., Götz, Johnstone, & Ratcliffe, 1999; Moor, 1972). Despite this dismissal of the original study’s conclusion, a public association between this specific chromosomal abnormality and criminality was still evident a few decades later (Conrad, 1997; Nelkin & Lindee, 1995).

Thus far, there is relatively little empirical research that reveals a specific genetic foundation for criminal behavior (cf. Alper, 1995; Caspi et al., 2002; Mednick, Brennan, & Kambel, 1988; Raine, 1993) although scientific interest in this association remains strong (e.g., Anderson, 2006; CIBA Foundation Symposium, 1996; Ellis & Walsh, 2000). Nonetheless, beliefs in a genetic foundation of criminality are common (e.g., 62% of White Americans believe that violent tendencies are at least partly genetic; Jayaratne, 2002), and these beliefs are important especially because of their moral and legal implications. Genetic attributions for antisocial behavior can lead to the naturalistic fallacy as well as perceptions of reduced control and culpability of the criminal actor. While the actual behaviors might not be perceived any less negatively when linked with genetic attributions (e.g., a society cannot tolerate rape, regardless of its underlying causes), the criminal actor may come to be viewed more sympathetically if the behaviors are seen to lie outside his or her control (Weiner et al., 1988).

Indeed, research findings regarding genetic associations with criminality have made their way into the U.S. court system (see Bernet, Vnencak-Jones, Farahany, & Montgomery, 2007). One of the basic notions of both judicial and popular perceptions of criminal culpability hinges on criminal intention, choice, and the ability to control one’s actions. *Mens rea* (Latin for “guilty mind”), the intentional element of a crime, is evaluated by jurors and judges, and in its absence the accused may receive a reduced sentence or even be exonerated. An apparent deterministic relationship between genes and criminal behavior reduces the perceived agency of a criminal actor and may make the behavior appear to be uncontrollable. For example, Cooper Dreyfuss and Nelkin (1992) compared two actual cases in which attorneys, who had been accused of misappropriating their clients’ funds, faced disbarment. The two cases were strikingly similar: both defendants appeared before the California Supreme Court; neither contested the allegations; and both identified alcohol abuse as the proximal cause of their misconduct. However, one of the attorneys argued that he had a genetic predisposition to alcoholism, providing a good opportunity for the court to assess the role of genetic attributions. The court found the attorney’s mitigation arguments of the genetic predisposition appealing, and he was placed on probation and allowed to continue practicing, while the other attorney was disbarred (cited in Cooper Dreyfuss & Nelkin, 1992, p. 328; for a similar judgment leading to acquittal, see *R. vs. Luedecke*, 2005).

Attributing criminal behaviors to a genetic predisposition may alter the perception of both the intentions and the culpability of the actor. There has been scant experimental research into this question, but one notable exception is a study by Monterosso, Royzman, and Schwartz (2005). Participants evaluated a number of vignettes describing criminal behaviors (i.e., murder and arson) in which the experimenters manipulated the perceived cause of the behavior by highlighting experiential or biological underpinnings

of the behavior. The behaviors that were explained with reference to experiential causes (e.g., the protagonist had a history of abuse), rather than biological causes (e.g., the protagonist had an inherited biological condition), were seen as more voluntary and blameworthy, attracted less sympathy, and were assigned more severe punishment (see also Phelan, 2005). This was so even though both versions of the vignettes contained identical probability estimates of the effects of the condition or experience (e.g., 20% of people with this condition/these experiences commit extreme acts of violence). In addition, participants felt that they were more likely to have behaved like the protagonists if they themselves shared the relevant genetic endowment but not if they had shared the same background experiences.

Similarly, exposure to a social account for mate selection strategies appears to decrease men's tolerance toward a male sexual offender compared with exposure to a genetic account for the same phenomenon (Dar-Nimrod, Heine, Cheung, & Schaller, 2010). In one study, men who learned of a gender-related socialization account for rape punished a man who engaged in date rape more than those who learned of a genetic account (i.e., rape is an evolutionary adaptive trait) or who were in a control condition. Findings for the control and genetic conditions did not differ, suggesting that the default theory for men's explanation of male sexual offenders is consistent with a genetic account. A second study found similar findings when men judged a culprit caught soliciting a prostitute after learning of a socialization account versus a genetic account for male promiscuity.

In another set of studies, investigators examined how deterministic beliefs are associated with immoral behaviors (although they did not explore genetic attributions of behaviors per se). Participants read a neutral essay or one in which the existence of free will was denied (i.e., "Ultimately, we are biological computers—designed by evolution, built through genetics, and programmed by the environment"), and then they were provided with an opportunity where they could cheat on a task for their own personal gain (Vohs & Schooler, 2008). In two studies, participants who read the deterministic essays cheated more than those who read the neutral essays. Although it is unclear whether the deterministic essays were effective because they highlighted the role of genes, the findings do demonstrate the relation between fatalistic beliefs and immoral behaviors.

The previously described studies show how genetic attributions for criminal behaviors mitigate evaluations of an actor's culpability in and control over the act. Direct evidence for the genetic foundation of criminal behavior is still rather limited, although more potential genetic associations and gene–environment interactions may be found in future research. However, the use of "my genes made me do it" may be limited as a legal defense, as it can be a double-edged sword: a lack of control over one's behavior may reduce one's perceived culpability, but at the same time, it increases perceptions of immutability and thus the subjective probability that the actor will commit similar acts in the future.

Genetic Essentialism and Mental Illness

Observations that some mental illnesses tend to run in families are not new. One of the main concerns of the eugenics movement of the previous centuries was the prevalence of such illnesses and other mental deficiencies (collectively referred to by the poorly

defined term of "feeble-mindedness"). Despite much evidence of substantial heritability in the transmission of mental illnesses, evidence for conditions that depend on a few genetic variants has thus far been limited to rare syndromes and certain biochemical diseases (e.g., Cohen syndrome, Wilson's disease; also see Stoltenberg & Burmeister, 2000). Perhaps the most widely known genetic link to a mental illness is the increased risk for depression that has been associated with a single polymorphism in the 5-HTT gene, depending on an individual's encounters with life stressors (Caspi et al., 2003). However, a recent meta-analysis revealed that even this poster child of gene–environment interactions does not replicate reliably (Risch et al., 2009). Thus far, the evidence for a genetic foundation of major mental illnesses defies a simple story and suggests that the norm might very well be that such illnesses involve dozens, or even thousands, of genetic variants. For example, schizophrenia, the psychopathology with perhaps the most clearly documented genetic foundation, has several thousand genetic variants associated with it (International Schizophrenia Consortium, 2009). Kendler (2005, p. 1250) forcefully stated that "the strong, clear and direct causal relationship implied by the concept of 'a gene for' does not exist for psychiatric disorders. Although we may wish it to be true, we do not have and are not likely ever to discover 'genes for' psychiatric illnesses."

People consider mental illnesses quite differently when such illnesses are perceived to have a genetic basis rather than an environmental one. On the one hand, given that mental illnesses can implicate moral concerns, genetic attributions may elicit the naturalistic fallacy, reduce perceptions of agency, and therefore induce sympathy toward those afflicted (cf. Angermeyer & Matschinger, 2004; Baker & Menken, 2001). This is consistent with Weiner et al.'s (1988) findings that attribution of undesirable elements to a physical factor (e.g., genes) can increase pity while simultaneously decreasing the perceived culpability of the afflicted person compared with mental–behavioral (e.g., choice) attributions. On the other hand, genetic attributions result in perceptions of immutability and reduced control, which can also be perceived to mean having less ability to rein in associated undesirable behaviors (Phelan, Cruz-Rojas, & Reiff, 2002; Schnitker, 2008). Further, genetic explanations are perceived as discrete—highlighting the distinction between those with and without the illnesses. Illustrating this latter point to the extreme, Mehta and Farina (1997, p. 416) suggest that "viewing those with mental disorders as diseased sets them apart and may lead to our perceiving them as physically distinct. Biochemical aberrations make them almost a different species."

Phelan and colleagues have investigated the relations between genetic or environmental attributions and people's perceptions of mental illnesses (e.g., Phelan, Cruz-Rojas, & Reiff, 2002; Phelan, Yang, & Cruz-Rojas, 2006). For example, Phelan et al. (2002) found that people who made stronger genetic attributions for schizophrenia perceived an afflicted individual as less of an active agent in the disease's onset. No such associations were found for environmental attributions. Furthermore, those who made stronger genetic attributions also expected a poorer prognosis for the patient. Likewise, other research has shown that stronger genetic attributions for mental illness are associated with an increased desire for social distance from those with such illnesses (Angermeyer & Matschinger, 2004) and their kin (Phelan, 2005). These findings are particularly important as lay people increasingly view

various mental illnesses to be a product of genes (Schnittker, 2008).

Experimental evidence similarly reveals genetic essentialist biases in people's views of mental illness. Exposure to genetic attributions for mental illness has been shown to increase the perceived seriousness and persistence of the illness (Phelan, 2005). Likewise, participants who were presented with a video of a person describing his schizophrenia symptoms followed by a biological account for the illness showed a significant negative change in their attitudes toward the mentally ill, viewing those with the mental illness to be more unpredictable and dangerous, compared with those who viewed a psychosocial account (Walker & Read, 2002; see also Read & Harré, 2001). Furthermore, health care providers do not appear to be immune to genetic essentialism. Those professionals who subscribe to biogenetic accounts for mental illness judge patients to be more disturbed than those who subscribe to psychosocial accounts (Langer & Abelson, 1974).

One study found that messages that portray mental illness as an outcome of both genes and the environment may reduce genetic essentialist reactions. Walker and Read (2002) included a combined genetic and social perspective manipulation in their study. They found that exposure to the combined perspective significantly reduced perceptions of danger associated with individuals with schizophrenia compared with exposure to a purely genetic account. This research raises the possibility that not all messages that contain genetic attributions necessarily lead to increased genetic essentialism. Highlighting psychosocial and environmental elements in addition to genetic ones may ameliorate essentialist biases as it challenges the specific etiology cognitions.

In sum, the ways that people perceive mental illnesses vary depending on what they believe is the origin of the illnesses. Mental illnesses that are linked with a genetic account tend to be perceived as more serious and dangerous and to engender more fatalistic expectations than mental illnesses linked with social factors; these views also affect attitudes toward the biological kin of mentally ill individuals. At the same time, genetic accounts can increase people's sympathy toward those afflicted. These reactions are all consistent with the notion that genetic essentialist biases makes people more likely to think of mental illnesses as immutable, as stemming from a specific etiology, and as reflective of homogeneous, discrete, and natural categories.

Genetic Essentialism and Obesity

Obesity is a domain in which people frequently encounter evidence for both genetic and environmental causal factors: for example, one may consider the role of genes in obesity when noticing that some friends do not lose weight despite being on a constant diet, whereas others stay thin regardless of what they eat. On the other hand, one may consider the role of the environment when noticing that the average person has gotten heavier than the average person in the past. Do people think of obesity differently depending on the kinds of etiological factors that they consider?

In one study, people's attitudes toward obesity were evaluated following presentations of different causal attributions of obesity (Teachman, Gapinski, Brownell, Rawlins, & Jeyaram, 2003). Participants showed more implicit anti-fat attitudes and less explicit pro-fat attitudes when they were offered a behavioral explanation

for obesity (overeating and lack of exercise) compared with those who received a genetic explanation.

Likewise, in another experiment, participants evaluating an overweight person who was described as an overeater viewed the actor's behavior as less controllable when the vignette describing the actor indicated that the individual had a gene associated with obesity compared with when the vignette contained a statement about a home environment antecedent (Monterosso et al., 2005). In addition, given that people tend to view obesity in moral terms (e.g., Crandall, 1994), participants also demonstrated the naturalistic fallacy in viewing the overeating behavior as less blameworthy when the vignette alluded to the gene as the antecedent rather than the home environment. Hence, research indicates that suggesting a genetic cause for obesity affects people's beliefs about the control that individuals have over their weight as well as how they evaluate the condition itself.

Another important question arises: how does exposure to such arguments affect people's own efforts to control their weight? In one study, investigators explored the behavioral outcomes of exposure to scientific claims regarding the existence of genes that relate to obesity (Dar-Nimrod, Ruby, & Heine, 2010). Participants read one of three different articles: an article describing evidence for an "obesity gene," an article describing evidence of how environmental factors (specifically social networks) relate to obesity, or a neutral article. Following the manipulation, participants took part in an experiment that purported to investigate their food preferences; they were provided with some cookies to evaluate. Those participants who learned of the existence of obesity genes subsequently consumed more cookies than participants in either of the two other conditions (which did not differ from each other). In this instance, it seems that people's default explanation for obesity is that it is under an individual's control. However, when exposed to a genetic argument, people appear to discount relevant variables such as their own eating behaviors, suggesting an increase in their deterministic perceptions of weight.

Summary of Genetic Attributions and Perceptions of Socially Constructed Categories

In sum, whether in regard to race and gender on one hand or sexual orientation, criminality, mental illness, and obesity on the other, arguments for underlying genetic contributions elicit more fatalistic reactions than arguments for underlying experiential factors, even when the potency of the two classes of arguments is carefully posed in equivalent terms (e.g., Dar-Nimrod & Heine, 2006; Monterosso et al., 2005). People come to identify with different cultures if they learn that genes underlie their race (No et al., 2008); people become more prejudiced when they learn that members of ethnic/racial outgroups differ in their genes (Keller, 2005; Williams & Eberhardt, 2008); women perform worse on math tests when they hear that men possess "math genes" (Dar-Nimrod & Heine, 2006); homosexuality is tolerated more if sexual orientation genes are believed to exist (Haslam & Levy, 2006); criminals are viewed as less culpable if they are perceived to possess genes linked to their crime (Dar-Nimrod, Heine, et al., 2010; Monterosso et al., 2005); mental illnesses are perceived as more serious if genes have been implicated (Phelan et al., 2002); and people eat more cookies when they learn of "obesity genes" (Dar-Nimrod, Ruby, et al., 2010). All of the genetic arguments that

participants encountered in these studies are examples of weak genetic explanations; it is not rational to think differently of these outcomes on the basis of the kinds of genetic information that were provided.

When characteristics of certain social group members are perceived to be linked with genetics, these characteristics are increasingly perceived as immutable, possessing a specific etiology, homogeneous, and natural. Such perceptions can lead to increased stereotyping and prejudice, especially when the membership in a social category is present at birth and is largely immutable, such as in the case of race and gender. Yet, when membership in a category is intimately tied to behavioral manifestations (e.g., homosexuality, obesity, and criminality), perceptions of volition may be reduced, diminishing the perceived responsibility of a member of a stigmatized category and eliciting sympathy and decreased condemnation. Further, in some situations, the increased perception of naturalness that stems from a perceived genetic etiology may trigger the naturalistic fallacy that ameliorates negative evaluations. Moreover, it is worth noting that behavioral genetics research indicates that almost all behaviors are, to a certain degree, heritable (Bouchard, 2004; Turkheimer, 2000), suggesting that these kinds of genetic essentialist biases may emerge in almost all domains in which heritability can be shown. For example, it seems likely that genetic essentialist biases would also be evident in how people view alcoholism or other addictive behaviors, how they consider the severity and prognosis of diseases, or how they consider various kinds of traits, attitudes, and abilities (e.g., Claassen et al., 2010). In future research, other domains may be identified in which genetic attributions demonstrate an inordinate influence on people's thoughts and behaviors.

This research reveals that not all scientific arguments are created equal, at least, not in terms of how they impact people who learn of those arguments. Characteristics described in scientific claims that reference genes are perceived as more deterministic than characteristics described in equivalent claims that reference environmental forces (e.g., Dar-Nimrod & Heine, 2006; Monterosso et al., 2005). Even though genes influence most life outcomes probabilistically—with the expression of the genes being dependent on the presence of certain environmental variables and interaction with other genes—genetic arguments activate people's essentialist biases, and those exposed to such arguments can come to view those outcomes in strikingly different ways. Genes, at least as most lay people conceive of them, can provide an unassailable materialistic explanation for why people act in the ways that they do.

Public Discourses and Genetic Essentialism

People with little formal training in genetics are regularly exposed to arguments regarding heritable qualities of humans and have been for centuries. In this section, we review how a discussion of genes, historically in the discourse around the eugenics movement and related public policies and in contemporary times with public portrayals of genetics research, interacts with people's genetic essentialism biases.

Genetic Essentialism and Eugenic Beliefs

The power of genetic essentialist biases is evident in the repeated rise of eugenic ideologies across history. We submit that

these ideologies follow directly from the ways that people perceive genetic foundations to be immutable, homogeneous, and fundamental to human character. When genes are perceived to be the locus of causality then it follows that efforts to improve humanity will focus on improving genes or the gene pool, more generally. We anticipate that eugenic ideologies will continue to arise as people try to integrate their social worldviews with their encounters with genetic discoveries relating to human characteristics. Below we briefly describe the history of eugenics and how it relates to genetic essentialism.

The first account of eugenics in the Western literature is evident in Plato's call for rulers to improve the state by controlling human reproduction (although he recognized that it was important that this policy remain hidden from the general population; Plato, 1956). That is, it was understood that people possess a heritable essence that varies in quality across individuals, although the mechanisms for this inheritance were not yet understood. It logically follows from this premise that if one wants to improve humanity, one could cultivate this heritable essence for future generations.

Other literary accounts through the ages have portrayed breeding programs designed to improve a nation or race (for more in-depth discussions, see Carden, 1969; Paul, 1995); however, this recurring desire to improve offspring and posterity lacked any scientific basis until the publication of Darwin's (1859) *The Origin of Species*. The link between Darwin's proposal of heritable traits that vary in fitness and a desire to improve the essence of the human race was too striking to miss, and Sir Francis Galton, Darwin's cousin, proposed in 1869 to harness the concept of artificial selection to improve the human race. Borrowing metaphors and scientific findings from animal breeding research, Galton set forth ideas that sparked growing interest from the scientific community in the late nineteenth and early twentieth centuries, and in the fertile soil of people's genetic essentialist biases, these ideas quickly spread throughout the industrialized world.

Eugenic ideologies were not just enticing to those with limited understanding of heritability or genes. Rather, eugenic ideas and practices were thoroughly embraced by some of the most eminent scientists of the time, among them Karl Pearson, Luther Burbank, and Ronald Fischer, and they were also joined by other prominent figures such as Alexander Graham Bell, George Bernard Shaw, and Theodore Roosevelt—all united in their desire to improve the quality of the human *germ plasm* (Black, 2003; Kevles, 1985; Nelkin & Lindee, 1995). In those early days, genetics was barely distinguishable from eugenics; for example, the entire founding editorial board of the American journal *Genetics* endorsed the eugenics movement (Paul, 1995). New organizations, such as the American Eugenics Society and Planned Parenthood, sprang up to champion eugenic ideologies, while established groups such as the American Breeding Association aligned themselves with eugenics (Black, 2003). Popular exposure to these ideas even reached local fairs on multiple continents, where positive eugenics were encouraged by competitions in which trophies were offered to the most eugenically fit families, couples, and babies (Paul, 1995; Robertson, forthcoming). Rarely has the world seen a scientific idea gain such popular appeal, which attests to how well eugenic ideologies resonated with people's essentialist biases.

The widespread appeal of the eugenics movement ended up being rather short-lived, but it is important to note that the decline of the movement was not primarily the result of concerns about the underlying science (although criticisms of eugenics theories did grow throughout the 1930s; Kevles, 1985). Rather, the abrupt demise of the eugenics movement was largely due to a growing comprehension of and disgust with the inhumanity that eugenics policies entailed.

In North America, a number of policies were influenced by eugenics ideology and purportedly “scientific data.” The American Immigration Act of 1924 lowered immigration quotas from countries whose citizens allegedly possessed high levels of inherited deficiencies in intelligence and morality (Kevles, 1985). By the early 1900s, the majority of the states in the United States had legislated restrictions on marriage for the mentally deficient on explicitly eugenic grounds, and these were extended to limitations on interracial marriages (Black, 2003). This development was followed by efforts to control reproduction through sterilization; 22 states legalized forced sterilizations, resulting in approximately 20,000 legal sterilizations being performed by the mid 1930s (Kevles, 1985). Canada similarly legalized compulsory sterilizations in two provinces (Dowbiggin, 2003).

These horrors of North American eugenics policies were ultimately trumped by the rise of National Socialism in Europe and its overt embrace of eugenic racial ideologies. The Nazis enforced restrictions on marriage, followed by sterilization programs of unparalleled magnitude (Kerr & Shakespeare, 2002) that culminated in the systematic extermination of “undesirable elements” (e.g., Jews, Gypsies, homosexuals, individuals with disabilities). Ultimately, it was the revelation of the magnitude of the carnage committed by the Nazis that caused the public and the vast majority of the scientific community to reject eugenic ideology more completely than any scientific refutation ever had (Black, 2003). Obviously, there are many causal accounts behind the rise of eugenics, but we submit that such horrors were made possible because the notion of improving the human gene pool appealed to a large proportion of the population, the underlying logic of the idea resonating with people’s genetic essentialist biases.

Nonetheless, despite the visceral negative association that many have with eugenics, remarkable advances in genetics research have continued to prompt considerations of new ways to better people’s lives. A rapidly growing understanding of genetic identification and manipulation has led to such advancements as dietary interventions for monogenic disorders such as phenylketonuria, prophylactic mastectomies for carriers of alleles associated with breast cancer, experimental gene therapy for diseases such as severe combined immunodeficiency, and preimplantation genetic diagnoses in embryos of diseases, such as Tay-Sachs, to name a few. Our point here is to underscore that when people understand genes as the underlying causes of life outcomes, they often aspire to control their genes in ways to improve those outcomes. We acknowledge that such kinds of gene-based technologies are valuable in that they stand to greatly improve people’s lives. However, we note a rarely considered cost of these advances in the context of people’s essentialist biases: these technologies, as they are communicated to and understood by lay people, reinforce the message that the source of life’s problems and the answers to those problems is located in our genes. It enhances the kind of sentiment reflected in a remark by Sir Francis Crick that “[n]o new born

should be declared human until it has passed certain tests regarding its genetic endowment” (cited in Schaeffer & Koop, 1979, p. 73). People’s genetic essentialist biases make it easy for them to assume that genes are the ultimate solution to social problems and that research on genetic technologies should be prioritized ahead of other kinds of interventions, some of which could prove to be more effective or cost-efficient. As noted by Horwitz (2005, p. 11), “focusing on genes . . . shifts attention from efforts to change environments to efforts to alter presumably defective genotypes.” Essentialist biases allow humans to be mesmerized by the siren call of genetic solutions to life’s problems.

In sum, the eugenics ideologies of the past did not flourish by chance, nor did they necessarily follow from any particular scientific discoveries. When people encounter some genetic arguments, they are more likely to think of groups of people as homogeneous and discrete, with their associated conditions being an immutable product of their underlying genes—ideas that share much in common with the logic of eugenics. People’s genetic essentialist biases, then, appear to cause them to be attracted to the notion that an improvable essence underlies all human challenges and glories. We submit that it was this attraction that led large numbers of normally good-natured people to consider and justify many morally repugnant acts of the early twentieth century in a misguided effort to improve the human race. Direct research on this question is largely limited at this point, but we suggest that genetic essentialist biases can, in some situations, foster the kinds of thinking that underlie eugenic perspectives.

Genetic Essentialism and Public Portrayals of Genetics Research

Genetics-related research often receives much attention from the media (Conrad, 2002; Nelkin & Lindee, 1995). As in the case of other scientific reporting, complex and difficult-to-understand scientific phenomena are simplified for the media audience. However, in the case of genetics reporting, the research is simplified to the point that many readers or listeners may get a misunderstanding of the phenomenon (although, arguably, media coverage of genetics research has a less deterministic viewpoint than in earlier decades; Condit, Ofulue, & Sheedy, 1998).

Because many, if not most, people derive their knowledge of genes largely from the media, it is important to consider how genetics research is communicated. Conrad (1997) examined in much detail the ways the media contribute to the concept of genetic determinism. He noted a number of biases in the ways genetic findings are communicated that make the genes appear to play a more central and deterministic role than the data actually suggest. First, research findings that portray genes as a cause of diseases and behaviors often receive far more coverage compared with later disconfirmations. And disconfirmations are an especially frequent occurrence in genetics research, given the small effect sizes of most associations (Rutter, 2006). The systematic discrepancy in exposure to genetic discoveries versus their disconfirmations may lead to an inflated view of genes as the primary causes of a variety of human phenomena.

Second, Conrad (1997, 2002) claimed that the media consistently provide an overly simplified picture of genetic research. Dubbed the *OGOD concept* (meaning “one gene–one disease”), it assumes a one-to-one deterministic relationship between a specific

gene and a specific disease or trait, which indicates a strong genetic explanation. The OGOD phenomenon is most evident in the titles of media reports. Headlines proclaiming that researchers have found a “gay gene” or an “evolution gene,”—or, worse still, that they have found “*the* gay gene” or “*the* evolution gene”—provide, at best, a grossly simplified version of the original findings or, at worst, a misrepresentation of the evidence (e.g., no “gay gene” was ever identified). Although such one-to-one relationships do exist in monogenic diseases (e.g., cystic fibrosis), these represent a tiny minority of diseases, and it is highly unlikely for psychological traits to be a function of just a few genes (Johnson, 2010). OGOD phenomena, however well they resonate with people’s genetic essentialist biases, are relatively rare.

Scant psychological research has been conducted on the direct effects of exposure to media reports about genetics on people’s attitudes. One exception is a study in which Eccles and Jacobs (1986) explored the reactions of mothers to media reports of an influential article by Benbow and Stanley (1980) that claimed that in math, boys outperformed girls with the same level of education. Three months after the initial media coverage of that article, data collected by Eccles and Jacobs (1986) indicated that mothers who reported that they had not read about Benbow and Stanley’s study (who were termed *uninformed mothers*) did not differ in their assessments of their children’s math abilities. In contrast, girls’ mothers who reported reading about the study (who were termed *misinformed mothers*) indicated that they believed that their daughters were less capable in math, would have more difficulties in math, and would have to work harder in math compared with estimates of their children’s math abilities made by the uninformed mothers or the misinformed mothers of boys. In addition, mothers’ beliefs about their girls’ math difficulties appeared to affect the girls’ math anxiety, which in turn was a strong predictor of the girls’ math performance and intentions to take additional math courses. In sum, exposure to genetic arguments regarding sex differences in math performance affected both attitudes and behaviors of girls toward math. It remains to be seen whether media coverage of other kinds of genetic findings would yield a similar pattern of findings.

Although genetics research is frequently oversimplified in media accounts, the media are not solely responsible for this oversimplification. Researchers themselves, competing for media attention and desiring to impress funding agencies with the potential implications of their research, have teamed up with their institutions’ public relations staff to produce reports that share some of the simplifications and consequent shortcomings found in media reports. Press releases based on initial, limited studies still make strong claims despite a genetic research track record riddled with disconfirmations. Although “overclaiming” is not specific to genetics research, such claims may be particularly problematic as they frequently imply strong genetic explanations when they are not justified and may enhance genetic essentialist biases and their related consequences. One indication of the role scientists have in conveying genetic determinism comes from research showing that the main media outlets in a number of countries typically do not greatly exaggerate genetic findings. A comparison between original scientific articles and the media coverage of the research revealed only a small percentage of severely exaggerated reports (Bubela & Caulfield, 2004). This suggests that the media’s deter-

ministic portrayals may often originate from the scientific articles themselves.

The typical communication of genetics research contains a few themes that resonate with people’s essentialist biases. First, scientists label the genes they study in ways that suggest an OGOD relation, in that the descriptions of genes often suggest a higher probability that carriers will show the related condition than is likely the case. For example, in the case of BRCA1 (breast cancer 1), the mutant allele is associated with a heightened risk for breast cancer; however, it is estimated to be involved in only about 5% of breast cancer cases (Conrad, 2002). Similarly, 71% of carriers of the allele of the so-called “Alzheimer’s gene” (APOE e4) never develop Alzheimer’s disease, and 44% of people with the disease do not have the APOE e4 allele (de Melo-Martin, 2005); furthermore, this allele is far less associated with Alzheimer’s in some populations (e.g., Hispanics and African Americans) than in others (e.g., Japanese; Farrer et al., 1997). The popular names of these genes fail to reflect this limited involvement, and media audiences likely infer that a particular gene plays a more central role in a disease than it actually does (Rothman, 1998).

A second common essentialism-evoking theme that often appears in scientific discussions of genetics is the use of essence-based metaphors to describe the human genome. The Human Genome Project has been described as the search for the “essence of life” (Coyne, 1995, p. 80), the “Holy Grail” that would enable the understanding of humanity (Morse, 1998, p. 219), and so on. These depictions make explicit reference to the genome as a sort of blueprint underlying human nature. Such metaphors can make for a compelling read; however, given that much of the way that people understand concepts is through metaphors (Lakoff & Johnson, 1980), they may lead people to conceive of genes as playing a deterministic role.

A third common essentialism-provoking theme is that genes are sometimes afforded a form of agency that may contribute to a mystical view of them as conscious entities that strip the person of his or her will. Genes are described as “selfish” or depicted as puppet masters (Dawkins, 1976) or are assigned conscious desires (e.g., “genes want . . .”; Burt & Trivers, 2006, p. 1). Used as a kind of poetic shorthand, such language may be no different than saying, “The clouds were angry that day.” However, the use of such terminology in discussions concerning genes relocates the locus of perceived consciousness and control and isolates it within the gene (e.g., Jayaratne et al., 2009). This phenomenon contributes to essentialist expressions in public discourses about genetics.

In sum, language plays a significant role in the way we think (e.g., Brown & Levinson, 1993; Lakoff & Johnson, 1980). The enduring essentialist framing of information regarding genotype–phenotype associations may play a key role in facilitating genetic essentialism. At the same time, genetic essentialist biases themselves lead scientists and reporters alike to summarize their research using overly simplifying OGOD descriptors, agentic portrayals, and essence-based metaphors. The experimental evidence that we have reviewed suggests that such distortions in the way genetic research is communicated may have a variety of negative consequences. The outcome is that people who gain their knowledge of genetics largely through the media are likely to conceive of genetic influences in overly deterministic, immutable, and ultimately erroneous ways.

Exploring Interventions to Reduce Genetic Essentialism

We have argued that genetic essentialism is powerful and pervasive and can have a variety of negative consequences. Is there a way that these biases might be reduced? Can people be led to appreciate how genetic accounts of an outcome do not necessarily mean that the outcome is immutable, homogeneous, and natural or has a specific etiology? At present, our suggestions for interventions are speculative, and researchers would contribute to the field by exploring some of them.

One potential avenue for interventions is to consider research that has identified moderators of genetic essentialism. Keller (2005) identified how one's belief in genetic determinism moderated the relations between exposure to genetic arguments and ingroup biases. He showed that students who strongly held such beliefs disliked immigrants more after exposure to an argument about the geography of genes compared with students who did not hold these beliefs as strongly. Hence, weakening people's beliefs in genetic determinism should arguably also weaken some of the harmful effects associated with genetic essentialism. There are likely other moderators of genetic essentialism that could be identified and targeted in interventions.

One strategy to undermine genetic determinism would be to call people's attention to the interactive relationships between genes and the environment. For example, Walker and Read (2002) found that people had more positive evaluations of schizophrenia when they encountered a gene–environment interaction explanation than when they encountered an exclusively genetic account. This provides some indication that genetics research can be communicated in a way that weakens genetic essentialist biases, largely by implying weak as opposed to strong genetic explanations. Perhaps, more generally, genetic essentialism would be weakened whenever the complexity between genotype and phenotype relations is explicated. People rarely appreciate that the expressions of genes are probabilistic and governed by experiences and interactions with other genes, nor do they generally consider how genes can influence the ways we interact with and are thus shaped by our environments (e.g., Johnson, 2007). Likewise, most people are probably not aware of the role that epigenetic factors play in the development of complex traits and diseases (e.g., Petronis, 2010). Perhaps if the relations between genes and outcomes were conveyed in all their intricate richness, people would respond to genetic accounts in less deterministic ways. Of course, an associated consequence of more complex explanations is that people might not feel that they understand how genes relate to outcomes. However, it is arguably less problematic for people to conclude that they do not really understand the complexity of genotype–phenotype relations than to incorrectly assume they understand the gist of these relations, because they frame the argument in essentialist terms. Scientific arguments are often complex, and few people outside the group researching the questions can understand them. Most people, for example, do not understand string theory, but at least in this case, they are not likely to lead their lives with the mistaken belief that they understand the general idea or make life decisions based on their faulty understanding.

Educational interventions of this kind would seem to be most appropriate during science classes in middle or high school. Adolescents do not show as strong nativist attributions as do younger

children (Gelman, 2003), and the adult form of misinformed genetic determinism is unlikely to have yet set in at adolescence. This is also the age at which the vast majority of future generations are educated in school about genetics; unfortunately, the subject often has been taught in incorrect and oversimplified ways that may have provided the foundation for genetic essentialist thinking. As research has indicated that increased education in general is sometimes associated with a reduction in belief in genetic determinism (Singer et al., 2007), we argue that specific education programs may yield even better outcomes. A reduced emphasis on examples of monogenic phenomena, such as Mendel's pea experiments, which suggest a strong genetic explanation, combined with increased emphasis on gene–environment interactions (e.g., Caspi et al., 2002; Miller & Chen, 2006) could be, at least, a starting point to enhance people's understanding of weak genetic explanations. A full revision of the manner in which genetics is taught in the classroom (e.g., Dougherty, 2009) may go a long way toward a solution. Further, genetics researchers need to be more cautious to avoid essentializing their findings in press releases. The reduction in deterministic media portrayals in recent years (Bubela & Caulfield, 2004; Condit et al., 1998) indicates that responsible media outlets may be willing to play their part.

In addition, given people's tendency to favor the naturalistic fallacy in considerations of genetic-based conditions with moral implications, perhaps reminding people about the naturalistic fallacy while they are learning of a genetic basis of a human quality will lessen essentialist thinking (but see Friedrich, 2005). Likewise, essentialist biases may be less likely to emerge if genetics research is presented alongside with a disclaimer highlighting the nondeterministic ways that genes relate to life outcomes. Such kinds of framing messages may serve to inoculate people from priming their essentialist biases. Future research into the effects of message framing and genetic essentialism will shed light on this important topic.

Conclusion

People are motivated to make sense of their social worlds. They encounter much human diversity, and in making sense of this, people are affected by at least two broad classes of etiological accounts, nativist and environmentalist explanations. These two kinds of explanations seem to be differentially emphasized across contexts and historical periods. While the pendulum continues to swing between these two classes of explanations, recent indications suggest that nativist perceptions are gaining the advantage in contemporary Western societies (e.g., Nelkin & Lindee, 1995; Paul, 1995), arguably reinforced by the zeal with which scientific explorations into the genome are communicated by the media. How people come to make sense of this information is a topic that psychologists have only recently begun to address.

There is much evidence now, in a variety of domains such as sexual orientation, criminality, mental illness, obesity, gender, race, and ethnicity, of causal relationships between genetic attributions as explanations of group differences and perceptions, attitudes, and behaviors. The common theme among these attributions is that they go beyond the scientific evidence, with weak genetic explanations being interpreted as strong genetic explanations. The result is that the gene becomes endowed with an almost mystical ability to shape individual and group characteristics, with

sociocultural and environmental elements largely being ignored. Once people consider the notion that genes are relevant for understanding some kinds of human conditions, they come to think of those conditions differently; the heritable component becomes the essential feature of the condition, increasing its causal influence. And once we frame genes as the cause of a problem, we are likely to also dwell on the notion that genes will represent the solution, and genetic engineering or eugenics policies may show an increase in their appeal.

The vast majority of this research has been conducted in Western cultural contexts, and although evidence for psychological essentialism has been found across many diverse cultural groups (e.g., Gil-White, 2001; Sousa et al., 2002), there is also evidence that some correlates of psychological essentialism, such as a tendency to favor dispositional over situational information as an explanation of the behavior of others (e.g., Choi, Nisbett, & Norenzayan, 1999) or a tendency to view the self in entity terms (e.g., Heine et al., 2001), are more pronounced in Western than East Asian contexts. Further, in one study, Chinese were less likely than Canadians to incorporate biological information about a target in making future predictions about that target (Lee, 2009). Hence, it is possible that genetic essentialist biases are more pronounced in Western contexts than in some non-Western ones. It is important to assess the degree to which genetic essentialist biases emerge similarly across cultural contexts (see Henrich, Heine, & Norenzayan, 2010).

Genetics research continues to produce important and intriguing new findings. On the one hand, such findings may eventually contribute to an increased quality of life in a wide variety of ways, from enhancing food production with genetically modified foods to improving health outcomes via gene-based therapies (although many of these have yet to live up to their promise; see Pearson, 2009, for a discussion on the questionable therapeutic benefits of the identification of even monogenic disorders). On the other hand, new genetic discoveries, as they are communicated to and are understood by the general public, tend to evoke essentialist biases. Hence, discussions of such research can be associated with strengthened fatalistic cognitions, a reduced belief in the importance of the environment in shaping human behavior, and a decrease in perceived individual choice. Although the scientific importance of genetic research is beyond dispute, taking steps to ensure a reduction in the undesirable cognitions and behaviors that have so far dogged the study of genetics will go a long way towards fulfilling the great promise encompassed in such research.

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