

*'Race' and the Human Genome Project:
constructions of scientific legitimacy*



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PATRICIA McCANN-MORTIMER,
MARTHA AUGOUSTINOS AND
AMANDA LeCOUTEUR
UNIVERSITY OF ADELAIDE

ABSTRACT. At the public announcement of the completion of a draft map of the human genome (June 2000), Craig Venter, Head of Celera Genomics and chief private scientist involved with the Human Genome Project, claimed that 'race' was not a scientifically valid construct. This statement, based on an analysis of the genomes of five people of different ethnicities, has not served to end the considerable discussion and debate surrounding the concept of 'race'. Using a social constructionist and critical discursive approach, this study analyses text and talk associated with the debate on the scientific validity of the concept 'race'. Given the problematic and highly contested nature of this concept, the present research examines, closely and in detail, a range of ways in which constructions of truth are worked up in scientific discourse. In particular, we analyse the ways in which empiricist and contingent repertoires within scientific discourse are mobilized to establish and contest claims of objectivity and facticity. We also examine a range of rhetorical devices deployed by protagonists in the debate to warrant particular truth claims including quantification rhetoric and the 'Truth Will Out Device' (TWOD). We conclude that despite the promissory representation of the Human Genome Project as having produced scientific evidence to discredit the biological legitimacy of 'race', the concept is likely to persist in both popular and scientific usage.

KEY WORDS: *critical discourse analysis, genomics discourse, Human Genome Project, race, scientific discourse, sociology of science*

The recent completion of a map of the human genome has been described as one of the most important and significant scientific developments in history. Advances in molecular genetics and the biosciences not only offer new possibilities for human biological intervention; they also have the potential radically to transform the ways in which we come to construct what it is to be human. Our

notions of self, personhood and identity will increasingly be shaped by the knowledge this research disseminates about the genetic bases of human behaviour (Novas and Rose, 2002). Among the heightened expectations generated by the Human Genome Project (hereafter, HGP), scientists optimistically claimed that the project would provide definitive answers to enduring questions concerning the scientific status of 'race' as a biological category. Indeed, following the completion of a draft map of the human genome in June 2000, Craig Venter (Head of Celera Genomics, and chief private scientist involved with the HGP) claimed that his analysis of the genomes of five people of different ethnicities had demonstrated that 'race' was not a scientifically valid construct. Typically, however, Venter's claim has not served to end the debate regarding the validity of the concept of 'race'. Using a discursive approach to examine the nature of fact construction, this article focuses on some instances of text and talk associated with the ongoing debate about the scientific validity of the concept 'race' that were generated in the public domain following Venter's claims. Given the highly contested nature of the concept, the present research aims to examine, closely and in detail, some of the ways in which constructions of truth about 'race' are typically worked up in scientific and media discourse. In particular, we analyse the ways in which empiricist and contingent repertoires are mobilized to establish and contest claims of objectivity and facticity. We also examine a range of rhetorical devices that were typically deployed in the debate to warrant particular claims about genetics and 'race'.

The concept of 'race'

Like the concept of gender, 'race' is entrenched in both popular usage and scientific discourse as a taken-for-granted, essentialist category. Essentialist views of 'race' emerged and proliferated in the first half of the 19th century and held that different 'races' constituted fixed and distinct biological entities or species (Richards, 1997). European imperialist expansion and colonial rule over indigenous peoples during this period created ideal conditions for the proliferation of essentialist beliefs. Such views were widely held among anthropologists, ethnographers and biologists between 1850 and 1910, and coincided with Social Darwinist beliefs about a natural biological hierarchy between different racial groups (Richards, 1997). Social Darwinism generated a fertile ground for the emergence of scientific racism and, in particular, the empirical investigation of biological and psychological 'racial' differences. This research program was vigorously pursued in the US between 1910 and 1940, particularly as 'race psychology' came to dominate the concerns of US psychologists. After the 1940s, however, influential scholarly critiques of scientific racism led to the eventual demise of this research focus.

Central to the decline of scientific racism was the discrediting of the validity of 'race' as a scientific category by geneticists during the 1930s (Cunningham-Burley and Kerr, 1999; Richards, 1997). The view that 'race' was not a scientifically

valid concept was further consolidated in the 1950s. Gannett (2001: S482) cites the UNESCO Statements on Race in 1950 and 1951 as marking 'a consensus among social scientists and natural scientists that population geneticists had successfully demonstrated that "race" is a social construct without biological foundation'. Richards (1997) argues that, by 1968, 'the concept of "race" was at best a convenient short-hand term for reproductively isolated populations . . . of dubious applicability to humans among whom such populations were extremely rare' (pp. 252–3). Despite the emergence of such constructions, and the fact that a majority of scientists from many disciplines saw 'race' studies as scientifically obsolete, debate over the scientific status of the concept has continued (Billig, 1998). The debate has been resurrected several times during the latter part of the 20th century, most notably in the controversy over 'race' and intelligence that was invoked by Jensen in the 1970s, and again in the 1990s by Herrnstein and Murray's populist writings on the 'bell curve', and Rushton's views on racial differences. In psychological research in particular, the concept of 'race' continues to be used unproblematically as a 'natural' kind variable in ways that reinforce the commonplace view that it is a biological and genetic reality (Tate and Audette, 2001).¹

Given the entrenched use of 'race' as a commonsense, 'natural' category to classify people in both everyday and scientific discourse, it is perhaps not surprising that Venter's statement regarding the scientific illegitimacy of the concept was met with skepticism and incredulity by scientists and members of the public alike. All indications suggest that the controversy over the scientific legitimacy of 'race' will continue well into the 21st century.

'RACE' AND THE HUMAN GENOME PROJECT

Throughout the last decade, the HGP was presented to the public as a research enterprise that was essential for the development of significant technological, scientific, and medical advances. Graphic metaphors were employed both by scientists and the media, in presenting this scientific knowledge for public consumption. The mapping of the human genome was depicted, for example, as a search for 'the essence of human life' and as the decoding of the 'book of life' (Nelkin and Lindee, 1995; Nerlich et al., 2002; Petersen, 2001). This promissory construction of the HGP not only emphasized how knowledge generated by this project would revolutionize science, but also stressed its enormous potential for alleviating human suffering associated with a range of medical and genetic disorders. At the same time, however, considerable controversy and criticism surrounded the project on a number of fronts. Most notable were concerns about the ethical and social consequences associated with the potential uses (and abuses) of genetic information and genetic interventions. Many critics also pointed to the proliferation of reductionist explanations for an array of human behaviors. During the last decade, numerous studies have purported to have discovered genetic links to a growing number of behavioural and personality characteristics. These have included traits such as creativity, aggressiveness, tendency to worry,

extroversion, novelty seeking, high anxiety, sociability, and sexual orientation (Rifkin, 1998). Nelkin and Lindee (1995), amongst others, argued that genetic essentialism was pervading popular culture and everyday public understandings of human behaviour. Analyzing diverse sources such as television, advertising, newspapers, magazines, film and literature, they demonstrated the increasing pervasiveness of genetic essentialism as a powerful discourse which 'reduces the self to a molecular entity, equating human beings, in all their social, historical, and moral complexity, with their genes' (p. 2). Moreover, persistent and entrenched social problems such as poverty, educational underachievement, mental illness, delinquency, alcoholism, violence, and criminal behaviour, were being increasingly attributed to 'deficient' or 'problematic' genes by experts, rather than to the social conditions in which people lived (Nelkin and Lindee, 1995; Rifkin, 1998).

Controversy also surrounded the Human Genome Diversity Project (HGDP), a sub-program of the HGP with the scientific goal of sampling and mapping the DNA sequences of diverse population groups. The project's emphasis on possible DNA group differences led to significant concerns about the potential of the project 'to contribute to racism' (Gannett, 2001). The project particularly targeted Indigenous groups for DNA sampling, though this was met with strong resistance from some Indigenous organizations who were aggrieved at not having been consulted. Some have branded the HGDP the 'vampire project' and described it as a form of 'genetic colonialism' (Dodson and Williamson, 1999). These concerns were hardly surprising given that research on human variation that has been categorized as 'racial' has a long history of being misused to justify oppressive social practices and to legitimate inequalities between groups. Indeed, a report issued by UNESCO's International Bioethics Committee in 1996 argued that the genetic information generated by the HGDP had the potential to be misappropriated for racist ends by those seeking whatever scientific support they could find to legitimate discriminatory beliefs (Gannett, 2001).

In contrast to concerns about the project's potential to support racist ideologies and practices, its advocates argued that the HGDP would prove once and for all that discrete biological 'races' do not exist (Gannett, 2001; Kohn, 1995); that 'race' was a *social* and not a valid *scientific* construct. According to Kohn (1995), scientists involved with the HGP claimed that, far from contributing to racism, the project would 'make a significant contribution to the elimination of racism' (p. 37) by demonstrating the biological unity and genetic heterogeneity of different population groups. Indeed, at the public announcement of the completion of a draft map of the human genome, this promise was partly kept.

On 26 June 2000, Frank Collins, leader of the publicly funded Human Genome Project, and Craig Venter, Head and Chief Scientist of the privately funded company, Celera Genomics, met at the White House with President Bill Clinton to announce their historic milestone to the world. President Clinton utilized a series of vivid metaphors to emphasize the scientific significance of the working draft, describing it as 'the most important, most wondrous map ever

produced by humankind', and 'the language in which God created life' (see Nerlich et al., 2002). Clinton, together with the HGP scientists, also presented this scientific advance as having widespread potential benefits such as eliminating endemic illnesses like cancer and heart disease. Moreover, Venter declared that the project had helped to 'illustrate' that the concept of 'race' 'had no genetic or scientific basis'. This scientific claim was re-affirmed in another Celera press release, issued when the genome map was published in *Science* and *Nature* in February 2001. The focus of the present article is a critical analysis of some of the text and talk that was generated in the wake of this scientific claim. As with previous recurring controversies over the scientific legitimacy of the 'race' concept, protagonists on both sides of the debate claimed the scientific high ground, drawing on empiricist explanatory repertoires to defend their positions. Our analysis aims to explore some of the discursive practices and rhetorical strategies that were typically deployed in the debate to warrant the facticity of positions, and to undermine potential opposing arguments.

SCIENCE IN THE MEDIA

As with many of the research findings generated by the HGP, the ensuing debate over 'race' was largely conducted publicly within the context of media reports and articles written for mass consumption. Recent research has emphasized the increasing importance of the media's role in disseminating science news, and in shaping public understandings of science. The public's increasing engagement and fascination with the science of genetics has been attributed, in part, to this media reporting. It is widely accepted that science journalism acts as a gatekeeper between scientists and the general public, and that science news may be reified or challenged according to the particular 'framing' employed by the science writer (Conrad, 1997, 1999, 2001; Van Dijk, 1988).

Van Dijk (1988) has identified three major devices that are used in media articles that present scientific news to the public. These include: offering supporting evidence from a range of reliable sources, giving indicators of 'precision and exactness such as numbers', and directly quoting expert sources (pp. 84–7). According to Conrad (1999), scientific experts are chosen to give perspective, balance, context and legitimacy, and exactly who is consulted can depend on their status, their accessibility and their ability to deliver a good quote. It has also been argued that science journalists sometimes choose experts according to whether their aim is to validate, or to problematize, the new scientific information. Thus, particular experts may be chosen because they are known to be strong proponents of a particular position, or because they could be expected to challenge and contradict the new findings (Conrad, 1999). These claims about features of media dissemination of science news are relevant to the present study as several of the texts under analysis were media reports pertaining to the controversy over 'race' and the HGP. Before turning to the texts in question, we also need to consider existing work in the sociology of science that has explored the specific and particular linguistic features of scientists' discourse.

Scientists' discourse

There is now a considerable body of social constructionist inquiry that has examined the discursive and rhetorical features of scientific discourse (e.g. Gilbert and Mulkay, 1984; Knorr-Cetina, 1981, 1996; Latour and Woolgar, 1979; Woolgar, 1988). Central to our analysis is Gilbert and Mulkay's (1984) classic study of biochemists' formal and informal accounts of competing theoretical hypotheses in oxidative phosphorylation research. Gilbert and Mulkay (1984) identified two recurrent interpretative repertoires that biochemists deployed in their writings and talk about research developments in their field, the 'empiricist' and 'contingent' repertoires. These two repertoires were selectively employed by scientists in various contexts in order to accomplish specific actions. As its name implies, the empiricist repertoire comprised lexical, grammatical and stylistic features that accorded agency and primacy to empirical data. Typically, data were depicted as emerging procedurally from rigidly conducted experimental procedures. Scientists primarily deployed the empiricist repertoire in formal accounts such as scientific papers, which were always constructed 'in an impersonal style, with overt references to the author's actions and judgements kept to a minimum . . . in which the physical world seems regularly to speak, and sometimes to act, for itself' (Gilbert and Mulkay, 1984: 57). Within this empiricist repertoire, scientists' actions were depicted as almost forced upon them by the phenomena of the natural world.

In direct contrast to the empiricist repertoire, scientists deployed what Gilbert and Mulkay labelled the 'contingent repertoire' in their informal talk about their scientific theories and practices. In this talk, scientists openly acknowledged the contingent nature of their activities and theoretical preferences, and emphasized how these were significantly shaped by personal and social factors such as 'speculative insights, prior intellectual commitments, personal characteristics, indescribable skills, social ties and group membership' (p. 56). It was also observed that, not uncommonly, these two contradictory repertoires occurred alongside each other in a range of situations; for example, in the context of speaking at a conference or during interviews with the researchers.

Scientists used the empiricist repertoire largely to justify and validate their own views and beliefs. In contrast, scientific opponents whose views were regarded as incorrect were described in terms of the contingent repertoire. Scientific errors by others were generally attributed to such personal and social factors as: tunnel vision, political manoeuvring, massaging the data (e.g. for publication, career advancement or to win grants), dogmatism, laziness, irrational thinking and reading misleading publications. Accounts of scientific error thus tended to invoke the contaminating intrusion of non-scientific and non-experimental factors – in other words – the doing of bad science. This erroneous science was seen in contrast to that performed by the speakers, who depicted their own views as invariably correct and unmediated representations of the natural world.

One of the significant features of the scientists' talk was the way in which they shifted flexibly between the empiricist and contingent repertoires in different contexts to justify and validate their scientific views and evaluations. When scientists were faced with contradictions that were made apparent through the concurrent deployment of these repertoires in their talk, they resorted to claiming that gradually, over time and given enough sound empiricist research, the truth of the natural world would reveal itself. Gilbert and Mulkay named this regular practice the 'Truth Will Out Device' (TWOD). The TWOD invokes the idea that empirical science progresses gradually, and although scientists may be temporarily misled by contaminating non-scientific factors, eventually these are corrected by virtue of the way in which objective facts inevitably assert themselves. Thus, the steady and gradual progress of science was viewed as an inherent safeguard against erroneous factual claims.

Our analysis will demonstrate the continuing relevance of Gilbert and Mulkay's findings to the understanding of some discursive practices associated with the current debate over 'race' as a scientific category. We demonstrate how the deployment of empiricist and contingent repertoires functions in the construction of truth and error claims in the debate, and how protagonists on both sides reaffirm their belief that 'science' will eventually solve the enduring controversy over 'race'.

The data

Data for the analysis were obtained via Internet searches for all available published texts pertaining to 'race' and the HGP, beginning with the public announcement of the completion of a draft map of the human genome in June 2000, and up to and including April 2002. The study included texts drawn from diverse sources such as newspapers, commentaries in scientific journals, scholarly magazines, press releases, and information from the Applera/Celera website. Although all texts were written for a wide general readership (even commentaries appearing in scientific journals), it is important to emphasize the heterogeneous nature of these materials, as not all articles were written in the genre of media scientific reporting. From these combined sources about 50 texts were collected, and from these, a final 20 were chosen for detailed analysis primarily on the basis that they contained material that was deemed central to the debate about 'race' and the HGP.

Given the problematic, and highly contested, nature of the concept 'race', the present research aims to examine the detail of how constructions of truth about 'race' are worked up in talk and texts. Our focus, too, on the rhetorical organization of the texts requires attention to how arguments are constructed to defend against, or to attack, alternative views, rather than to ascertain the truth or falsity of claims about 'race'. Specifically, our analysis aims to:

- 1 Demonstrate how the term 'race' is constructed and contested in texts and talk associated with the completion of the mapping of human genome.

- 2 Demonstrate the ways in which texts are organized, and 'rhetorical devices' are deployed, to establish an appearance of objectivity, facticity and 'out-there-ness' in scientific discourse associated with the contested concept 'race'.
- 3 Explore the broader functions of the discursive practices used in constructions of 'race' in these texts.

It is important to emphasize, again, that our analysis does not seek to determine the 'truth' about 'race', but rather to analyse, in fine detail, the ways in which truth claims were warranted and made to appear 'solid' and factual in various texts that constitute the current debate over the scientific status of 'race'.

ANALYSIS AND DISCUSSION

The debate over 'race' has centred on opposing constructions that have posited 'race' as a natural, biological (essentialist) category, versus a social construct that does not have a factual, scientific basis. Although this article analyses the contours of the most recent manifestation of this controversy, embedded as it is within the reported biotechnological advances associated with the HGP, it is significant to note that the arguments and discursive practices we identify, appear to be generally characteristic of previous debates on how 'race' should be constructed. We will analyse a number of texts sampled from the current debate beginning with Venter's (2000) statement, to examine the discursive practices characteristically deployed in conflicting constructions of 'race'.

'RACE' AS A SOCIAL CONSTRUCT: CONSTRUCTIONS THAT MINIMIZE GROUP DIFFERENCES

Venter's (2000) press release describing the completion of a draft map of the human genome consisted of 10 short paragraphs and was 1130 words in length. The statement made reference to the historical significance of this scientific milestone, and to the future potential of this genetic knowledge for curing disease and medical conditions. Venter's statement, however, also attended to the longstanding scientific controversy over 'race', and addressed some of the major criticisms that the HGP had attracted from its inception, including fears that it would lead to the proliferation of biological reductionist explanations of human behaviour, and to the possible discriminatory use of genetic information.

In Extract 1, Venter orients to the scientific controversy over 'race' by reporting on the findings of the project in relation to the concepts of 'race' and 'ethnicity'. This information is presented relatively early in the press release, in the second paragraph. What can also be seen in Extract 1 is an instance of the use of an empiricist discourse of science which, as Potter (1996) has observed, is a practice that helps build a sense of facticity by making 'descriptions separate and external to the actor' (1996: 121).

Extract 1

- 1 The method used by Celera has determined the genetic code of five
- 2 individuals. We have sequenced from the genomes of three females

3 and two males who have identified themselves as Hispanic, Asian,
 4 Caucasian, or African American. We did this initial sampling, not in
 5 an exclusionary way, but out of respect for the diversity that is
 6 America, and to help illustrate that the concept of race has no genetic
 7 or scientific basis. In the five Celera genomes there was no way to tell
 8 one ethnicity from another.

This extract can be considered in terms of its similarities and differences to the descriptions provided by Gilbert and Mulkay (1984) of scientists' reports of their theories and experimental procedures in formal and informal contexts. First of all, we can see the use of a grammatical form that is typical of formal reporting in scientific papers: 'The method used by Celera has determined . . .' (l. 1). This impersonal style minimizes the involvement of the author, their actions, commitments, and interpretations. The orientation to 'method', here, is also characteristic of formal scientific writing, carrying with it assumptions of a standard, universal procedure for generating scientific knowledge. These are key features of the empiricist repertoire.

It is of interest, though, that immediately following this impersonal scientific statement, a plural pronoun is used to describe some details of the method: 'We have sequenced . . .' (l. 2), 'We did this initial sampling . . .' (l. 4). Standard, impersonal, formal alternatives can be imagined for each of these statements: 'The genomes . . . were sequenced', 'This initial sampling was done . . .', but these impersonal forms are not used here. By the fourth sentence in the extract (ll. 7–8), we see a reversion to the impersonal form of construction. We are informed that, 'there was no way to tell one ethnicity from another' (compare, as potential alternatives, forms that continue the 'we' usages: 'We could not find any way to tell . . .'; 'We could not tell any differences . . .'). The extreme-case formulation of this statement of results ('there was *no way* to tell') also works to counter potential alternative readings of the genomic code 'evidence' in relation to 'race'. As Pomerantz (1986) pointed out, the use of extreme terms to modify descriptions is a common practice that is designed to strengthen an argument, particularly when an issue is in dispute. What can be seen happening, in between the two impersonal, empiricist framings of standard scientific procedure and results, is a nice piece of interest management of the part of the author. He inoculates against possible charges that the project involves some sort of racist profiling ('We did this initial sampling, not in an exclusionary way, but out of respect for the diversity that is America . . .'), and in the process, provides a nationalistic warrant for doing so. But what is also achieved, very neatly, with this construction of stake or interest is a confession of motivation, of what is driving the research project. First of all, 'respect for . . . diversity . . .' drives the project. This assertion serves to counter potential claims that genetic differences might have been present, but were suppressed in a motivated way. Presumably those who are respectful of diversity would not try to ignore its effects if there was evidence of them in the genetic code. However, at the same time, this confession of motivation leaves open the possible charge that *political values* are driving the project. Indeed, we see later

how such attributions were mobilized by Venter's critics. Second, we are told that the project was motivated by a desire 'to help illustrate that the concept of "race" has no genetic or scientific basis'. This admission is also potentially problematic in the sense that it flouts the 'value-free', objective, received view of the nature of science, and yet its framing in positive terms ('to help'), and in relation to a social problem that social scientists, at least, have focused on resolving for generations, works to counter potential criticism along this line. This formulation can also be seen to be producing a quality of what Potter (1996) refers to as 'out-there-ness' in relation to the description of 'race' as having no genetic basis. Celera's procedures and the findings from them are described as 'illustrat[ing]' something that chronologically pre-exists them. To illustrate, or throw light on, or draw a picture of a thing, is strongly suggestive of that thing's independent existence 'out there'. Also of significance in this extract is the manner in which the sample of five individuals whose genomes were mapped is described. We are told that these individuals have *self-identified* as Hispanic, Asian, Caucasian or African-American (ll. 3–4). What we can see here is a description of 'racial' categories being worked-up as something that is social, that can be self-selected by individuals as preferred social identities.

In the next extract from Venter's press release (paragraphs 6 and 7) we can see other types of discursive and rhetorical work through which the factual status of 'race' as having no genetic basis is built up. In particular, Extract 2 contains the frequent use of numbers and quantification in ways that enable descriptive contrasts. The use of such contrastive procedures, that Potter (1996) has labelled 'maximization and minimization', is a central feature of rhetoric.

Extract 2

- 1 We are clearly much more than the sum totals of our genes, just as our
- 2 society is greater than the sum total of each of us. Our physiology is
- 3 based on the complex and seemingly infinite interactions among all of
- 4 our genes and the environment, just as our civilization is based on the
- 5 interactions among all of us.
- 6 One of the wonderful discoveries that my colleagues and I have made
- 7 while decoding the DNA of over two dozen species from viruses to
- 8 bacteria to plants to insects, and now to human beings, is that we are all
- 9 connected through the commonality of the genetic code and evolution.
- 10 When life is reduced to its very essence, we find that we have many
- 11 genes in common with every species on Earth and that we are not so
- 12 different from one another. You may be surprised to learn that your
- 13 protein sequences are greater than 90% identical to proteins from
- 14 other mammals.

In this extract we can see 'informal quantification' being used to maximize the extent of similarity between the 'genes', 'DNA' and 'genetic code' of human beings and other living things. Terms such as 'greater', 'seemingly infinite', 'all', 'every', 'many' and 'commonality' work to reinforce the idea that 'we are not so different from one another.' (ll. 10–11). A more specific quantitative characterization is

provided in relation to 'protein sequences', where humans and other mammals are described as being 'greater than 90% identical'. This characterization of extreme quantifiable similarity is interesting in its selectivity. We are now talking, not of genes and genetic code, but of 'proteins' and 'protein sequences'. In this sense, the specific form of quantification is used as part of a process of ontological gerrymandering, in which a particular range of phenomena are picked out as relevant to the description in order to advance the argumentative case. As Potter (1996: 187) has pointed out, such gerrymandering practices are immensely powerful: 'The choice of boundaries and the huge range of descriptive terms available mean that highly contrasting versions of the "same thing" can be produced while resisting criticisms of inaccuracy, falsehood or active confabulation'. Indeed, what Venter accomplishes in this process of gerrymandering is to emphasize the 'essential' (l. 9) commonality of all living things ('every species on Earth'; l. 10). As we shall see, this emphasis on biological continuity – that, deep down, we are very similar and that surface characteristics belie fundamental similarities – is a repertoire commonly mobilized by those questioning the biological status of 'race'.

Although Venter argues for the *essential* biological continuity of all life forms here, it is of significance that he also orients to potential criticisms that the genome project will engender genetic reductionism. In ll. 1–4, he attends to this concern when he states, categorically, that: 'We are clearly more than the sum totals of our genes . . . Our physiology is based on the complex and seemingly infinite interactions among all our genes and the environment'. In this way, biogenetic explanations are undermined as being 'clearly' insufficient explanations.

The last extract that we consider from Venter's statement comes from paragraph 9 of the press release. Here we can see another offensive orientation to one of the central criticisms that had been levelled at the project; the potential for appropriation of genetic information for discriminatory purposes. We can also see some key features of both the empiricist and contingent repertoires that Gilbert and Mulkay described as characterizing scientists' reports about their own (correct) and others' (erroneous) work.

Extract 3

- 1 some will want to use this new knowledge as a basis of discrimination
- 2 . . . While those who will base social decisions on genetic reductionism
- 3 will ultimately be defeated by science, new laws to protect us from
- 4 genetic discrimination are critical in order to maximize the medical
- 5 benefits from genomic discoveries.

In l. 1, there is a reference to an erroneous or ab-use to which an indefinite 'some' will want to put the knowledge generated by the HGP. These erroneous applications are attributed to a contingent factor – to the moral shortcoming of 'social' (and, by implication, illegal) discrimination. We can also see, in l. 3, an example of a key feature of the empiricist repertoire of science: the TWOD. Gilbert and Mulkay (1984) described the TWOD as form of accounting that scientists

typically drew upon to explain the existence of opposing views. The outcome of a mapping of the human genome was, as mentioned previously, expected to bring an end, once and for all, to debate about the genetic basis of the concept of 'race'. Maps, produced via the standard and universal procedures and method of science, can be read; the facts should be available for observation by anyone trained in the appropriate method. Patently, the availability of such a map has not produced a resolution but, 'ultimately' (l. 3), we are assured here, the facts will assert themselves. Those who hold the wrong (and morally and legally deficient) view will 'be defeated by science' in the end.

Venter's press release has been cited widely by journalists and scientists writing in the media. His statements have been both supported and contested. A close analysis of some examples of these evaluations of Venter's claims about the HGP and 'race' demonstrates the ways in which the empiricist and contingent repertoires described by Gilbert and Mulkay are drawn upon by both sides of the debate. The following extract comes from an article entitled 'Do Races Differ? Not Really, DNA Shows' by a *New York Times* science writer (Angier, 2000).

Extract 4

- 1 . . . scientists' growing knowledge of the profound genetic fraternity
- 2 that binds together human beings of the most seemingly disparate
- 3 origins.
- 4 Scientists have long suspected that the racial categories recognized by
- 5 society are not reflected on the genetic level.
- 6 But the more closely that researchers examine the human genome – the
- 7 complement of genetic material encased in the heart of almost every
- 8 cell of the body – the more most of them are convinced that the
- 9 standard labels used to distinguish people by 'race' have little or no
- 10 biological meaning.
- 11 They say that while it may seem easy to tell at a glance whether a
- 12 person is Caucasian, African or Asian, the ease dissolves when one
- 13 probes beneath surface characteristics and scans the genome for DNA
- 14 hallmarks of 'race'.
- 15 As it turns out, scientists say, the human species is so evolutionarily
- 16 young . . . it has simply not had a chance to divide itself into separate
- 17 biological groups or 'races' in any but the most superficial ways.

In this extract, what we can see is a series of contrast structures being developed in order to build a persuasive case that apparent surface differences between 'racial' groups belie deeper/underlying similarities. In ll. 1–3, the contrast being introduced is that between 'profound' likeness/similarity and seeming disparity. We have the contrasts: like versus unlike and deep versus surface at work. Then, in ll. 4 and 5, comes a contrast between scientists' knowledge on the one hand, and society's understanding on the other. In ll. 6–10, these contrasts are brought together to build a compelling case: scientists/researchers use 'close' 'exam[ination]' of material that is 'encased' at the deepest of levels, 'in the heart of almost every living cell of the body'. 'Society', by contrast, uses labels in order to 'distinguish'

people in a way that lacks 'biological meaning'. This non-scientific form of distinguishing, 'telling at a glance' (l. 11), only 'seems' meaningful; it is inferior to scientific knowledge because it is based on 'surface characteristics' (l. 13), it is superficial (l. 17). Atkinson's (1984) classic text on political rhetoric emphasized how the use of contrasts in this way makes a message more persuasive and convincing. Edwards and Potter (1992) claim that the building of contrasts is a rhetorical process whereby a 'factual' version is constructed in opposition to an 'alternative, which is itself formulated in an unconvincing or problematic manner' (p. 163).

In another extract from this text we can see some more uses of quantification rhetoric to strengthen the claim that 'race' does not have a significant genetic basis.

Extract 5

- 1 The human genome is large, though, composed of three billion-odd
- 2 subunits, or bases, which means that even a tiny percentage of
- 3 variation from one individual to the next amounts to a sizable number
- 4 of genetic discrepancies.
- 5 The question is, where in the genome is that variation found, and how
- 6 is it distributed among different populations?
- 7 Through transglobal sampling of neutral genetic markers . . . researchers
- 8 have found that, on average, 88 percent to 90 percent of the differences
- 9 between people occur within their local populations, while only about 10
- 10 percent to 12 percent of the differences distinguish one population,
- 11 or race, from another.
- 12 To put it another way, the citizens of any given village in the world,
- 13 whether in Scotland or Tanzania, hold 90 percent of the genetic
- 14 variability that humanity has to offer.

This account presents a version that minimizes the amount of variation between 'races', and maximizes the amount of difference that occurs between people 'within local populations'. A contrast is made between small percentage characterizations of genetic difference due to 'race' (ll. 9–10 'only about 10 percent to 12 percent') and large percentages due to local population variability (l. 8 '88 percent to 90 percent'). This contrast is framed within a claim of extreme order of absolute quantity for the human genome – that it is composed of 'three billion-odd subunits or bases' (ll. 1–2). The case is made, using a contrast between this extreme figure and a minimized 'tiny percentage of variation from one individual to the next', that even small variations between individuals 'amounts to a sizeable number of genetic discrepancies'. The inference is that racial differences, if genetically based, should be traceable to similar 'sizeable' genetic differences between 'races'. However, as we are told in ll. 7–11, and then again in ll. 12–14, such large differences in genetic markers are not to be found within 'races'.

Of interest too, in this extract, is the particular range of phenomena picked out in the description of the process of measuring genetic differences between people: 'through transglobal sampling of neutral genetic markers' (l. 7). This

description selects one realm – ‘neutral genetic markers’ – to make the case for little genetically based ‘racial’ difference. Again, this would seem to be an instance of ontological gerrymandering in which rhetorical boundaries are drawn in the way most advantageous to the argument being made.

The next text that we will examine also comes from an advocate of the position that ‘race’ is not a scientifically valid construct. In this case, the text is another Celera press release, this time authored by Culliton (2001) who cites in length, a member of the Celera Review Board (Dr Harold P. Freeman) on the eve of the publication of the human genome map in the highly reputable journals *Science* and *Nature*:

Extract 6

- 1 Mapping the DNA sequence variation in the human genome holds the
- 2 potential for promoting the fundamental unity of all humankind.
- 3 Throughout recorded history and up to the present time, countless
- 4 human conflicts have occurred based on how groups of people have
- 5 seen, classified and behaved toward another group. . . In the past, some
- 6 scientists used observations of racial differences to support racist
- 7 doctrines. Racism, rooted in the erroneous concept of biological racial
- 8 superiority, has powerful societal effects and continues to influence
- 9 science.
- 10 Race as used in the United States is a social and political construct
- 11 derived from our nation’s history. It has no basis in science. The
- 12 biologic concept of race is now believed to be untenable.
- 13 The power of science can be used to eliminate public perceptions of
- 14 racial superiority and inferiority, which are the basis of racism itself.
- 15 In this way, the mapping of the human genome could be pivotal in
- 16 promoting the concept of one race, the human race.

In this text we can see another example of the use of the contingent repertoire to explain the erroneous views of others. In ll. 5–9, the case is made that those who promulgate biological bases for ‘race’ are motivated by racism, even within the realm of science. There is much focus, too, in this account on history and the past. A sense of how bad things were in the past is repeatedly worked up. History is depicted as a time of ‘countless human conflicts’, of ‘racism’. We are presented with a contrast between these historical evils and errors, and the true understandings of contemporary science (l. 12: The biologic concept of ‘race’ is no longer believed to be tenable). A similar contrast structuring is deployed to work up an opposition between science and the ‘social and political’ (ll. 10–11: Race . . . is a social and political construct . . . It has no basis in science). Using yet another form of contrast structuring, science is positioned as superior to lay understanding. Science is described as having agency – ‘power . . . to eliminate’ false ‘public perceptions’ (ll. 13–14). The humanistic promise of progress from ignorance to understanding, from conflict to harmony and happiness, of widespread human betterment, is a strong feature of this account. The mapping of the human genome is depicted as holding the potential for the achievement of ‘unity’

amongst 'humankind'/'the human race'. The rhetorical self-sufficiency of arguments that are framed in terms of values such as 'unity' has been commented upon by analysts such as Billig (1991) and Wetherell and Potter (1992). These arguments are difficult to undermine, they enjoy something of the status of socially accepted clichés and, because they involve principles that are beyond question, require no further warrant.

A pattern of contrast structuring involving science and society or 'culture' was also present in many of the analysed texts. In the following example, a geneticist writing in *Science* (Paabo, 2001) provides another favourable account of the findings of the HGP.

Extract 7

- 1 Fortunately, from the few studies of nuclear DNA sequences, it is clear
- 2 that what is called 'race,' although culturally important, reflects just
- 3 few continuous traits determined by a tiny fraction of our genes.
- 4 Thus, from the perspective of nuclear genes, it is often the case that
- 5 two persons from the same part of the world who look superficially
- 6 alike are less related to each other than they are to persons from other
- 7 parts of the world who may look very different.

Here, 'race' is depicted as a cultural concept (l. 2) (compare 'a social and political construct', l. 10 in Extract 6); it has no scientific significance. This claim is reinforced by a minimization of references to genetic bases for racial differences: '*just a few* continuous traits determined by *a tiny fraction* of our genes' (ll. 3–4). Again, the general style of writing is in terms of declarations that permit no doubt as to their veracity: 'it is clear that' (l. 1–2); 'Thus . . . it is often the case that . . .' (l. 4). And, once again, we can see a contrast being worked up between surface appearances, 'look superficially alike' (ll. 5–6), and what is true at a deeper, genetic level.

To summarize, the textual extracts examined above illustrate what is a recurring trope in arguments that 'race' has no basis in genetics: that superficial, physical (surface) differences belie the underlying genetic unity of all human beings. There is a common rhetoric of quantification, too, running through these texts in which scientists and reporters argue that the concept of 'race' has no genetic basis. This quantitative characterization typically involves a diminution or minimization of the importance of differences based on 'race'. For example, racial differences are described using terms such as 'surface', 'superficial', 'external', 'very minimal', 'seemingly disparate', 'few' and 'tiny fraction'. By contrast, talk of human similarity emphasizes the *relationship* of human beings with terms such as 'fundamental unity', 'profound genetic fraternity', 'commonality', 'universality', 'connected', 'related' and 'bind together'. Contrasts play an important role in these descriptions. Surface appearances are contrasted with deeper genetic 'perspectives' or ways of looking for the facts. Science is contrasted with the social and political; that is, with *interested* forms of making sense of the world. Typically, too, science is contrasted with 'public' knowledge, which is portrayed as inferior.

'Race' as a biological construct: Constructions that emphasize group differences

In this section we examine several texts that disputed claims that the mapping of the human genome had proved that 'race' had no basis in genetics. Not surprisingly, one feature shared by these texts was an emphasis on the differences rather than the similarities between 'racial' groups. The first of these extracts comes from an article entitled, 'The straw man of "race"' (Entine, 2001), published in a monthly journal, *The World and I* (described as 'academic-scholarly' by Ulrich's Periodicals Directory, 2002; Bowker, 2002).

Extract 8

- 1 The fact that 99.8 percent of the population shares the same genes does
- 2 not 'prove' or even necessarily suggest that there are no population or
- 3 'racial' differences. The percentage of overall differences is a far less
- 4 important issue than which genes are different. Even minute
- 5 differences in DNA can have profound effects on how an animal or
- 6 human looks and acts . . .

The argument set forth here is designed directly to counter the standard terms of the opposition's claims. We can see the author orienting to the other side's deployment of quantification rhetoric (l. 1: The fact that 99.8 percent of the population shares the same genes) in order to undermine this claim or re-frame its meaning (l. 2: does not 'prove' or even necessarily suggest). This offensive rhetorical action is accomplished, in part, by disputing the ontological terrain. The author refuses to accept the selective boundaries of the phenomenon of debate as they have been presented by the opposition: 'The percentage of overall differences is a far less important issue than which genes are different' (ll. 3–4). He then engages in his own contrast between minimized genetic differences (l. 4: 'Even minute differences in DNA') and maximized external/observable differences (ll. 5–6: 'can have profound effects on how an animal or human looks and acts').

In the next extract, Entine quotes Arizona State University evolutionary biologist Joseph Graves Jr, an expert with category entitlement, to provide corroboration for the view that physical differences between human groups are significant and that genes are implicated in these differences. It is significant also that Entine makes explicit reference to Graves' 'racial' identity, describing him as 'African-American' (ll. 3–4). This description here is rhetorically significant in that it constructs Graves as an expert whose views are counter to what one normally would expect from a minority group member. Thus this description inoculates against potential criticisms that this expert may have a particular stake or interest (an 'axe to grind') in arguing for the significance of group differences (Potter, 1996).

Extract 9

- 1 'Evolution has shaped body types and in part athletic possibilities.
- 2 Don't expect an Eskimo to show up on an NBA court or a Watusi to
- 3 win the world weightlifting championship, adds Graves, who is African

4 American. Differences don't necessarily correlate with skin colour, but
 5 rather with geography and climate. Endurance runners are more likely to
 6 come from East Africa. That's a fact. Genes play a major role in this.'
 7 [188 lines omitted]
 8 The fact that monolithic racial categories do not show up consistently
 9 in the genotype does not mean there are no group differences between
 10 pockets of populations,' agrees Arizona State University Evolutionary
 11 biologist Joseph Graves Jr. 'There are some group differences. We see
 12 it in diseases'.

Entine directly quotes Graves who asserts that 'There are some group differences' (l. 11) and as 'a fact' that genes 'play a major role in this' (l. 6). Note, also, how visible physical characteristics that are commonly used to define 'racial' groups such as 'skin colour' (l. 4), are downplayed in contrast to criteria such as 'geography and climate' (l. 5) in this account. Again we see here an instance of ontological gerrymandering in which a specific set of criteria is selected as relevant to the description in order to argue for a particular position. Although 'skin colour' proves to be problematic, in that this marker does not 'necessarily correlate with' (l. 4) group differences, in contrast, 'pockets of populations' (l. 10) do demonstrate such differences, according to Graves, particularly in the incidence of disease (l. 12). Indeed, references to ethnic group differences in the incidence of certain kinds of disease, and responses to certain medical treatment, were commonly deployed by experts who sought to defend the legitimacy of identifying biological group differences (see Extract 10).

Attributions of stake and interest, suggesting that the genome scientists were motivated by factors other than purely scientific ones (i.e. contingent factors), was another common offensive device mobilized to undermine the claim that 'race' was not a biological construct. In the next extract, drawn from the beginning of Entine's article, we can see a contrast being worked up between (false) ideology and (true) science.

Extract 10

1 Ideological doublespeak on evolution is now infiltrating genetic science.
 2 The latest volley in the hundred-years war can be traced to statements
 3 issued earlier this year by the National Human Genome Project
 4 Director Francis Collins and Craig Venter of Celera Genomics. When
 5 these two distinguished scientists unveiled their crude maps of the
 6 human genome, they went out of their way to emphasize that, in the
 7 words of Venter, 'race has no genetic or scientific basis.' Venter's
 8 unambiguous declaration created hardly a ripple in social science
 9 circles which have long embraced this position.

Ideology is described here as duplicitous (l. 1); it is 'doublespeak', not 'truth', and it is difficult to detect or counter (it 'infiltrates'; it is not easy to observe). The use of the descriptor, 'distinguished' (l. 5), in relation to the 'opposition' scientists is interesting here. Presumably, the usage is designed to be sarcastic given the propinquity of the next descriptor, 'crude' (l. 5), used to refer to the maps of the

human genome they have generated. Furthermore, the scientists, Venter and Collins are described as having gone 'out of their way to emphasize' (l. 6) their conclusion that 'race' has no genetic basis. The extremity of their actions suggests inappropriate motivation or interest. Here, too, (ll. 8–9) we see science being contrasted with social science – an inferior form of knowledge because of its purported interest-driven 'embracing' of the social/political.

The next text arguing against claims such as Venter's that 'race' has no basis in genetics is an extract by a science writer from an article that appeared in the national broadsheet, *The Weekend Australian* (Brooks, 2000). We can again see, here, a contrast being built up between the political and the scientific; between interest and factuality.

Extract 11

- 1 'A politically correct statement,' some scientists say.
- 2 'A factual statement,' say others.
- 3 Confusion reigns. What did Venter mean? Surely not that the physical
- 4 differences of different ethnic backgrounds are not genetic?
- 5 It's established scientific fact that African-Americans have a higher
- 6 precedent of sickle anaemia because the same gene made their African
- 7 ancestors resistant to malaria; that most Ashkenazim Jews' genes came
- 8 from a tiny population that moved to Europe and caused an evolutionary
- 9 bottleneck; and that many Japanese livers contain an enzyme that is
- 10 inefficient at absorbing alcohol.

The extract begins (ll. 1–2) by presenting the conflicting responses that the HGP findings had elicited from scientists: 'a politically correct statement' by opponents, on the one hand, and a 'factual statement' by proponents, on the other hand. The ironic questioning that occurs in ll. 3–4 ('What did Venter mean? Surely not that the physical differences of different ethnic backgrounds are not genetic?'), carries the implication that Venter's statements defy commonsense belief. These questions are followed by a statement of what is 'established scientific fact' (l. 5), and a three-part list (African-Americans have . . . most Ashkenazim Jews' genes came from . . . many Japanese livers contain') is deployed to add a sense of generalized support to this empiricist warrant. Three-part lists are described by Jefferson (1990) as commonplace rhetorical constructions that are robust against attack, in their suggestion of the generality of the principle they are illustrating. This list of 'established scientific facts' about group differences echoes the scientific claim in Extract 9 regarding group differences in the incidence of disease.

In a further extract from this article, we can see the author working up the notion that interest rather than science was the motivation for Venter's claims.

Extract 12

- 1 Brandon Wainwright, the Brisbane-based deputy director of the
- 2 Human Genetic Co-operative Research Centre, believes . . . 'There may
- 3 end up being DNA sequences that are specific to race, specific to

4 population.' Wainwright says Venter may have made the statement
 5 to avoid the spectre of genetic racism.
 6 Dr John Morrison, research scientist and geneticist at Monash Medical
 7 Centre in Melbourne agreed that Venter would have wanted to avoid
 8 the genome project sparking fears about race.

In this extract, two scientists with well-detailed category entitlements to speak on issues of genetics are reported indirectly (ll. 4–5 and ll. 7–8) as suggesting that Venter might have had political reasons for claiming that the concept of 'race' had no genetic basis; more specifically 'to avoid the spectre of genetic racism', and 'to avoid the genome project sparking fears about race'. Such suggestions about the research claims of those with whom one disagrees are typical of the contingent repertoire of scientific explanation. Invoking political reasons as a motivation works, here, to undermine the basis upon which Venter has claimed to be speaking – that of empiricist truth.

The last extract we consider comes from an article entitled 'Under the skin', published in *New Scientist* (Ananthaswamy, 2002). This article is of particular interest because, unlike the other texts that we have examined in this section, it does not seek to question the scientific illegitimacy of the concept 'race'. Indeed, it argues that conventional 'racial' groupings *are* scientifically erroneous, but that nevertheless, it may still be possible to identify human groups according to 'genetically similar clusters' (p. 34).

Extract 13

1 So the races we think we see have little relevance to biology.
 2 But is there a better way to get at humanity's underlying genetic
 3 variations? David Goldstein of University College London thinks so . . .
 4 and that finding it is mainly a matter of studying the right genetic markers.
 5 'We are all using too small a number of markers,' he says. 'My
 6 guess is that when we use a large enough set of markers and an
 7 exhaustive enough set of individuals, the results will stabilise.
 8 In fact, I'm quite sure that they will'.

What we can see in this extract is another example of the TWOD that Gilbert and Mulkay identified in their scientists' talk. A genetics researcher, Goldstein is reported as arguing that, over time, given the identification of the 'right genetic markers' (l. 4) and a sufficient sample size of both markers and individuals (ll. 6–7: 'a large enough set of markers and an exhaustive enough set of individuals'), more scientifically valid human groupings will *eventually* be identified along genetic/biological lines. Note also how in l. 8 he qualifies his initial hedging in ll. 5 and 6 ('My guess is') that scientific researchers will ultimately find such genetic markers to, 'In fact, I'm quite sure that they will'. In this way, Goldstein offers up hope that science will, given time and the application of the correct method, discover how correctly to identify valid human groups according to genetic variations.

The texts we have examined in this section have sought to challenge and

undermine claims by HGP scientists that 'race' was not a biologically valid construct. We demonstrated how such underminings were accomplished through the deployment of constructions that emphasized the magnitude and significance of observable physical differences between human groups, and how genes or biology must be implicated in such differences. Typically, these constructions were framed within the empiricist repertoire of science as various experts with category entitlement were enlisted by authors to cite 'facts' about group differences across several domains such as athletic ability and the incidence of disease. We also demonstrated how contingent factors were commonly mobilized by critics to suggest that Venter was motivated by contaminating non-scientific factors, such as 'political correctness', to make this statement about 'race'. Typically, again, contrasts between science and politics were instrumental in accomplishing such attributions of stake and interest.

Concluding remarks

In this article we have seen how protagonists on both sides of this debate typically drew upon the rhetoric of science to legitimate their position, primarily by means of invoking the empiricist repertoire. In pursuit of their claims to scientific 'truth', both sides employed 'defensive' rhetorical devices such as quantification to warrant the 'factual' nature of their position. Science is, not surprisingly, equated with the empiricist, experimental tradition in which quantification is a highly valued aspect. As Potter et al. (1991: 359) have pointed out, 'Quantification is an extremely powerful tool, but one which is socially constituted and rhetorically exploitable'. Indeed, we have seen how those questioning the scientific status of 'race' used both formal and informal quantification in ways that *minimized* differences and *maximized* the similarity between conventional 'racial' groups. In contrast, those maintaining the biological and scientific validity of 'race' deployed quantification in ways that served to *emphasize* the significance and magnitude of group differences.

When 'offensive' rhetorical devices, such as charges of stake and interest and references to commonsense or what 'everybody knows', were deployed to undermine alternative versions of what 'race' is, arguments were typically framed in terms of 'poor science' or 'contingency'. As previously discussed, Gilbert and Mulkey (1984) found that scientists typically attributed the views of their opponents to a range of contaminating, non-scientific factors. Our analysis identified several such contaminating factors that were attributed to the erroneous views of those wanting to uphold the biological legitimacy of 'race', including discrimination (Extract 3), scientific racism and faulty public perceptions (Extract 6). Similarly, proponents of the view that 'race' is a valid biological concept attributed the erroneous views of their opponents and, in particular, Venter, to contingent factors such as ideology (Extract 9), 'political correctness' (Extract 10) and the desire 'to avoid the spectre of genetic racism' (Extract 11). Such practices, therefore, appear to be the norm in scientific controversies.

Our analysis also demonstrated instances of the TWOD (Gilbert and Mulkay, 1984) being deployed by protagonists on both sides of the scientific controversy over 'race'. Indeed, Venter's press release can be seen to be a public declaration of the TWOD. It was a declaration that science and, more specifically the HGP, had finally solved the enduring controversy over the scientific status of 'race'; that the 'truth' or objective facts about 'race' had now come to the fore through the mapping of the human genome. Moreover, Venter's statement also functions to assert that the 'truth' about the biological illegitimacy of 'race', that can be verified through the scientific sequencing and mapping of DNA, will ultimately defeat those who are motivated by discrimination. Venter, like other experts (Extract 6), assures us that science has the inherent power to eliminate and defeat such enduring social inequities. Clearly, however, as we have demonstrated, Venter's claim finally to have solved the question of 'race' was not universally accepted, but was subject to considerable scientific challenge.

In addition to the mobilization of contingent factors and oppositional sets of numbers, another discursive practice used to contest Venter's views involved shifting the ontological boundaries of the concept 'race'. Central to this definitional shift was the argument that, although conventional 'racial' categories as typically understood may not be defined by particular genetic markers, 'pockets of populations' living in particular geographical locales could be so defined. This view resonates with current thinking in population genetics, which, since the 1950s, has replaced a traditional typological concept of 'race' with a populational one (Gannett, 2001). The decline of scientific racism in the 1950s has been partly attributed to this shift to population thinking by geneticists and anthropologists. However, as Gannett (2001) has argued, there are no ethical guarantees that population thinking, particularly as it is applied to the study of human biological diversity, will be 'an effective arbiter of boundaries between what counts as "good" (objective and morally responsible) science and "bad" (false and racist) pseudo-science' (p. S481). Despite the empirical 'facts' mobilized by human genome diversity researchers to emphasize the genetic continuity and heterogeneity in humans, an objective of such research is to identify 'statistical differences among populations' in gene frequencies associated with particular characteristics such as disease incidence. As Gannett (2001: S490) argues, 'group DNA differences will always be culturally meaningful and socially relevant – even if these groups in no way correspond with traditional racial divisions, and even if these DNA differences are quantitative not qualitative'. Regardless of how 'groups' are defined, and no matter how small the reported differences between groups, such group differences can always be (mis)appropriated to legitimate racist and discriminatory practices. It will take much more than the rhetorical power of scientific 'truth' to eradicate racism.

NOTE

1. This is by no means limited to the discipline of psychology, however. 'Race' continues to be treated as a natural variable in many disciplines. See for example, critiques on the use of 'race' in public health and epidemiological research by Bophal and Donaldson (1998) and Fullilove (1998), and Lin and Kelsey (2000).

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PATRICIA MCCANN-MORTIMER is currently a postgraduate student in the Department of Psychology, University of Adelaide. Previously she worked as a rehabilitation consultant at the Commonwealth Rehabilitation Service (Australia).
[email: patricia.mccann@psychology.adelaide.edu.au]

MARTHA AUGOUSTINOS is Associate Professor and Co-Director of the Discourse and Rhetoric Unit (DARU) in the Department of Psychology, University of Adelaide, where she teaches social psychology. She has written extensively on racist discourse in Australia.

ADDRESS: Department of Psychology, University of Adelaide, SA 5005, Australia. [email: martha@psychology.adelaide.edu.au]

AMANDA LECOUTEUR is Associate Professor and Co-Director of the Discourse and Rhetoric Unit (DARU) in the Department of Psychology at The University of Adelaide where she teaches in the areas of qualitative research methods, gender and metapsychology. [email: amanda.lecouteur@psychology.adelaide.edu.au]