

AN ABSTRACT OF THE THESIS OF

Kathryn Atwood-Wheeler for the degree of Master of Arts in Interdisciplinary Studies in Women Studies, History and Sociology, presented on June 10, 2008.

Title: Gender and Race Stereotypes in Advertisements in *Science*, 2004-2006.

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This study documents the occurrence of stereotypical representations of gender, race, and other characteristics in individuals that appear in advertisements in the prestigious academic journal *Science*. It repeats and expands upon a study conducted by Mary Barbercheck (2001) that analyzed advertisements in *Science* between 1995 and 1997. In this study, advertisements larger than one third of a page that contained a human figure (N=1809) were analyzed in terms of perceived race, gender, occupation, and social characteristics of the individuals shown in all 154 issues of *Science* published from 2004 through 2006. Relevant occupation and social characteristics of the individuals were identified; specifically it was noted if the individuals appeared to be a scientist, a scientific hero or expert, an athlete, a “nerd” or nonconformist, or a caregiver of a child. Additionally, the use of the words *simple/easy* and *efficient/fast/reliable/accurate* in these advertisements was tracked. Every appropriate advertisement was included in the analysis each time it appeared, which allowed a complete and thorough examination of the trends revealed in the advertisements. These data were contrasted with Barbercheck’s 1995 through 1997 data in order to reveal how the use of stereotypes in advertisements in *Science* has changed since the late 1990s. Analyses indicate that scientific advertisements increasingly portray a diverse population. However, social stereotypes and historical

dominance of the sciences by certain social groups within the United States continue to be represented in these advertisements, emphasizing how social and cultural norms significantly inform and reflect the manner in which scientific advertisements are composed.

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Gender and Race Stereotypes in Advertisements in *Science*, 2004-2006

by

Kathryn Atwood-Wheeler

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Kathryn Atwood-Wheeler, Author

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INTRODUCTION

Stereotypes in Advertisements in *Science*

The American Association for the Advancement of Science's (AAAS) weekly academic journal *Science* presents both important scientific information and messages about social and scientific values and norms. Published articles adhering to the scientific method demonstrate the nature of scientific inquiry and the importance of the peer review process. Likewise, advertisements featuring human beings visually depict social and cultural information through the use of characteristics such as race and gender. The individuals shown may be depicted in a socially stereotypical manner, even against the contrasting backdrop of scientific objectivity and impartiality.

In 2001, Mary Barbercheck published a review of the representations of gender, race, and other characteristics in *Science* (Barbercheck, 2001). The purpose of Barbercheck's study was to examine cultural messages about gender, race, and science contained in advertisements. Barbercheck found that:

The advertisements in *Science* share biases similar to those in the popular media, where science is portrayed most often as an inappropriate activity for women. What is problematic is that such conventional stereotypes occur in the pages of *Science*, a

prestigious and highly respected journal published by a scientific society whose goals include the active promotion of diversity and elimination of discrimination in science (2001, p. 130).

According to Barbercheck, advertisements in *Science* in 1995 through 1997 predominantly featured White males. Women and people of color were represented less often and in lesser ways. Barbercheck found that, at this time, the American scientist population was in fact more diverse in terms of gender and race than was reflected in the advertisements. White males in these advertisements were shown not only to engage in science more often, but also to attain a degree of scientific mastery rarely attainable by women or people of color. Barbercheck's study therefore revealed a discrepancy between the stated social goals and values of *Science* and the stereotypical presentation of the individual scientists in the advertisements contained in its pages.

This gap between theory and practice defied AAAS's commitment to diversity by adhering to discriminatory and socially biased beliefs about the type of person who professionally practices science. Barbercheck revealed that the use of race and gender stereotypes in scientific advertisements effectively created a problematic lack of diversity and positive imagery in scientific media. Although AAAS's professional commitment to diversity in science in practice was not questioned, the advertisements revealed that women and people of color persistently faced challenges to success due to social and cultural bias. In this way the larger social context directly influenced the ostensibly impartial and unbiased scientific community. Social systems that create and reinforce social biases in science were consequently evident in the advertisements.

Barbercheck intended to bring to light the significance of race and gender distribution in her study. In doing so, the importance of diversity was promoted. Currently, AAAS states on its website that it is fully committed to ending discrimination in science. It aims to advance “the cause of truly equal opportunity for everyone in the scientific and engineering professions” that restricts fair educational and career advancement (American Association for the Advancement of Science Board of Directors, 1974).

Analysis of the advertisements is valuable primarily because it provides a method by which to identify key reflections of social narratives about people and science. Systematic social bias becomes particularly relevant in this method of analysis because advertisers consciously and unconsciously reproduce dominant or idealized views of science and scientists. In this way the relative distribution of race and gender in advertisements, as well as the manner in which individuals are presented, has distinct social significance. The narratives that are created in scientific advertisements about men, women, and people of color provide insight into the status of these groups in scientific communities and society in general. These narratives also reflect challenges faced by these groups.

As Barbercheck’s study provided valuable insight into the social inequalities presented in scientific advertisements, an update on that information provides two advantages. First, more recent data allow an analysis of the way in which the characteristics of the individuals in the advertisements has changed. Significant shifts should be noted because they indicate changes in the viewpoints of advertisers and

possibly in the larger social context. Second, updated data would further explore the continued significance of the social and cultural challenges that individuals face or the assets that individuals possess in the scientific landscape.

This study examines the use of gender and racial stereotypes in the advertisements in *Science* in the years 2004 through 2006. These stereotypes provide insight to social norms and social power. The relevant data is compared with Barbercheck's data regarding the 1995 through 1997 issues of *Science* in order to determine how the use of stereotypes has or has not changed.

Although *Science* is an American publication, it aims for international readership and authorship. As a general science journal, it publishes news, reviews and research from a variety of fields. However, the biological and life sciences are heavily represented in the circulation. AAAS (2008b) states that as of August 2007, of the 130,969 qualified weekly subscribers, 90,870 life scientists receive *Science* each week. The total worldwide weekly readership of the print version totals over 700,000 individuals. AAAS further states that the primary area of work or interest of the individual readers is 43% cell biology, 41% biochemistry, 36% genetics, 31% biotechnology, 26% neuroscience, 26% cancer biology, 25% genomics, 24% bioinformatics, 24% microbiology, 20% drug discovery, 19% proteomics, 17% drug development and 16% pharmacology. According to the National Science Foundation (2006c) in 2003 the sex distribution in the biological or life science fields was fairly even, as the scientists were about 43% female and 57% male. As males and females are somewhat equally represented in these life and biological science fields, and these

fields represent a large proportion of the subscribers to *Science*, it is likely that the readership of science is less divided by sex than a journal aimed at a field that is clearly dominated by either males or females. Accordingly, the advertisements may overrepresent females compared to a scientific journal aimed at a discipline that is dominated by males.

Advertisers in the print issue can select from a variety of advertisement placement, size and format options; advertising rates are based on these options (American Association for the Advancement of Science, 2008a). Specific options include display advertisements ranging from one sixth of a page to double-page spreads, line advertisements which are billed on a per-line basis, and advertisements placed in special advertising sections based on a specific topic or focus. All advertisements are subject to the approval of AAAS. Specific regularly occurring advertising sections of the journal include the cover, the table of contents, This Week in Science, editorial sections, the Marketplace and the back cover.

Overview of Methods

This study is created specifically to update and expand upon the information provided in Barbercheck's study. This study provides significant information about the changing status of women and people of color in contemporary science settings as reflected in advertisements in scientific media. By comparing the data in this study with the data provided by Barbercheck, detailed analysis of human figures in scientific advertisements is used to draw conclusions about recent trends in the representation of various social groups. The data also expose changes in attitudes towards women and

people of color. Finally, this study provides new qualitative and quantitative information that captures in greater detail the status of women and people of color in scientific advertisements. In these ways the analysis presents prominent themes relevant to the way stereotypes in advertisements relate to social norms and social power.

In order to most effectively compare and contrast the data in this study with Barbercheck's data, a similar methodology is employed. Both quantitative and qualitative methods of analysis are used. In this study I examine human figures in pictorial advertisements greater than one third of a page in *Science* as Barbercheck did for the calendar years of 1995 through 1997. Three calendar years of issues are reviewed, spanning from 2004 through 2006. For each advertisement meeting the basic requirements, the race and gender of each individual is recorded. This information provides the necessary statistics with which to measure quantitative differences in race and gender distribution between the advertisements in the two time periods.

Additional characteristics of the individuals in the advertisements are tracked. Tracking of these characteristics, such as if an individual is depicted as a scientist or not, establishes use of more specific race and gender stereotypes. This information is compared with the data in Barbercheck's study. In this way the analysis fully captures contemporary changes in the representation of scientists and science.

Finally, the social nature of advertisements is highlighted through analysis of word use and advertisement context. As in Barbercheck's study, the connotation of

specific words used in advertisements is compared to the relevant characteristics of the person featured in the advertisement. In this way a correlation between words and social stereotypes is examined. Additionally, the context in which an advertisement appears is analyzed. The context, specifically issue type and advertisement type, highlights the grounding of scientific advertisements in society and culture through the advertiser's use of an intended audience. Through a comparison of the new data with Barbercheck's data, the study provides insight into how the images presented by advertisers has evolved. These changes reflect changes in the social systems guiding scientists and non-scientists alike.

This study examines the distribution of gender and racial stereotypes in the journal *Science* over time. First, it is likely that race and gender distribution in the 2004 through 2006 advertisements more accurately reflects the actual statistics of the United States population and its scientists than was the case in the previous study. The use of negative gender and racial stereotypes has likely diminished in the advertisements featured between 2004 through 2006 compared to 1995 through 1997.

Limitations

The primary limitations in this study directly relate to both inadequate photographic clarity and observer bias. First of all, although the sample size ideally includes all advertisements greater than one third of a page featuring a human figure, uncertainties with regards to gender and race necessarily exclude some advertisements from the analysis. These uncertainties generally arise from the obscuring of gender or race through intentional and unintentional photographic composition. Second,

observer bias may potentially sway coding of the various categories of analysis including race, scientist status, and “nerd” or nonconformist status. My own frameworks for understanding the world and people are inescapable and may influence data coding. Finally, in regards to racial categorization, this study is unavoidably limited to four major groups, namely White, African American, Asian American, and Other, without regard to an individual’s unique ethnicity or mixed racial heritage. This limitation again stems from the restricted amount of data available in the photographic evidence. In absence of a detailed personal history for the individuals featured in the advertisements, it is taken as axiomatic that the most likely racial heritage of the subjects will be utilized for categorization.

Delimitations

The delimitations of this study reflect the design of the study originally conducted by Barbercheck. This study is likewise restricted to a period of three calendar years. Use of that time period is required to accurately create conditions for appropriate comparison with Barbercheck’s data. The exclusive use of the journal *Science* for sampling is also necessary to ensure that a systematic direct juxtaposition can take place. The use of Barbercheck’s categories of analysis similarly re-creates the original conditions of the study.

Organization of the Thesis

This thesis is divided into five chapters. Chapter one presents the basic concept of the study, its theoretical perspectives and its objectives, establishing the relationship of this study to its predecessor. Chapter one also presents the significance

of the study along with an overview of the methodology, limitations, and delimitations. Chapter two examines the related literature that provides the theoretical and practical foundations for the study. Chapter three reviews in detail the study's methodology. The process of data selection, categorization, and analysis are presented. This chapter also provides information on the ways in which this study is similar to Barbercheck's study and the ways in which it differs. Chapter four reports the study results. Chapter five contains a discussion of these results in comparison with previous data. The significance of the data and a detailed discussion of specific illustrative examples are presented. Chapter six presents the conclusions.

LITERATURE REVIEW

Introduction

This chapter focuses on works relevant to the intersection of social stereotypes and scientific advertisements. First, the theoretical foundations of this study are presented in order to establish the research approach and boundaries. Second, the significance of stereotypes in advertising is discussed. Third, real concerns about gender and race in science are addressed. Lastly, the synthesis of advertising, science, and stereotypes are examined.

Theoretical Foundations

In this study advertisements are treated as symbolic texts to be read and deconstructed. The theoretical foundations of this study were therefore selected based on the need for a semiotic analysis and a critical evaluation of the social stereotypes depicted in the advertisements. Postmodern feminism is utilized because it provides a means to critically analyze visual symbolism, scientific knowledge, and social power.

Postmodernism allows a thorough examination of knowledge from a viewpoint that highlights the illusion of objectivity (Hammers & Brown, 2004). Language is seen to construct reality rather than reflect it. Language and discourse act as a foundation for understanding and resisting social inequality (Whitehead, 2001). Words and language can be analyzed as signs because their meanings are bound to the social and cultural context in which they circulate (Waniek, 2005). Semiotics allows detailed

deconstruction of language, which in turn allows critical examination of knowledge (Perry, 2006).

Feminist epistemologies fundamentally examine knowledge as practice in light of the context in which it arises and operates (Secord, 2004). Postmodern feminism explores how gender is created through symbols and symbolic interaction. Although gender is a primary focus, postmodern feminism embraces multiple rather than singular viewpoints; identity factors such as gender, race, and sexuality are intersected rather than ranked. Postmodern feminism embraces a diversity of perspectives, in contrast with standpoint and radical feminism which tend to embrace a singular understanding of women collectively (Hutchinson & Mann, 2004).

Two key components of postmodern feminism were identified as particularly relevant to a discussion of gender, race, and other stereotypes displayed in scientific advertisements. These components are: embodiment of the self and critical analysis of the disembodiment of science. These theoretical factors are particularly relevant to this study because they critically examine the concept of scientific objectivity as well as allowing evaluation of the depiction of science and scientists in a symbolic manner. Together these elements provide the basis for recognizing and analyzing the stereotypes depicted in the advertisements in *Science*.

Embodiment refers to the way in which knowledge and perspective is mediated through the body. Social location relative to others influences knowledge production (Michaelian, 2008). Factors such as gender, race, ethnicity, class, and sexuality influence embodiment and have a real impact on lived experiences. The perception of

intellectual and social characteristics are influenced by embodiment (Baez, 2004). The significance of the differences between individuals and groups is socially constructed. Accordingly, social norms and narratives vary across time and cultures (Jandt & Hundley, 2007). Social construction of gender, most closely associated with Judith Butler (1990), focuses on the way in which masculinity or femininity is inscribed on the body (Hutchinson & Mann, 2004; Waniek, 2005). Gender is constructed according to social norms; rather than reflecting biological sex, it is a performance of social norms (Chilcoat, 2004; Cosgrove, 2003; Hammers & Brown, 2004; Waniek, 2005). Although postmodern feminism elevates gendered experiences, it rejects an essentialist or universal notion of “woman,” as well as essentialist notions of race (Cosgrove, 2003). Essentialism is criticized because it reduces the differences between individuals and the influence of social forces on them by instead generalizing about the group as a universal unit (Baez, 2004; Hammers & Brown, 2004; Williams & Sewpaul, 2004). Experience of oppression and freedom is experienced through the body based through factors, such as “race, gender, class, culture, nationality, ethnicity, age, sexuality, (dis)ability, and reproductive status” (Hutchinson & Mann, 2004, p. 84). Characteristics such as these act as identity signifiers that are marked upon the body (Chacon, 2006).

Although individuals experience the world through their embodiment, ideal scientific inquiry and process is conventionally thought of as objective and impartial; it appears to be *disembodied* (Shapin, 1995). Postmodern feminism challenges the idea of disembodied knowledge and, in fact, scientific objectivity. The notion of

“disembodied scientific objectivity” is called into question because it attempts to transcend the inescapable process of knowledge production (Haraway, 1988, p. 576). Knowledge is not created in a vacuum; it is inescapably connected to the human community.

In summary, postmodern feminism focuses on the embodiment of the self as a function of social power. The disembodiment of objective knowledge is an illusion. This illusion is also a function of social power. The embodiment of the self and the false disembodiment of knowledge are both socially constructed. Recognition and analysis of the process of knowledge construction provides a viewpoint from which to critically examine both knowledge and social inequalities.

Perspective, then, is critical to understanding and reforming our notions of objectivity. Postmodern feminism owes much of its philosophy regarding vision to the anthropologist Donna Haraway. Haraway is best known for her works *Primate Visions: Gender, Race and Nature in the World of Modern Science* (1989) and *Simians, Cyborgs and Women: The Reinvention of Nature* (Haraway, 1991). In the article *Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective* (1988) Haraway critically examined how scientific observations that are mediated through technology do not lack perspective and ideology. The close examination of technologically mediated vision provided by Haraway functions as a metaphor for scientific objectivity in general.

Haraway argues that the technologies that allow humans to view natural phenomena in a way that is not possible with the human eye reinforce the notion of

disembodied and impartial science. These mediated visions appear as if from a view from outer space, or from nowhere at all. In this sense the “god trick” provided by technologies provides a visual representation that seems to be absent of perspective (1988, p. 581). The technologies that frame our understanding of science and of scientific knowledge tend to obscure the way in which knowledge is impacted by social norms and values. The neutrality of scientific technology is limited by epistemic and social values (Hanna, 2004). Knowledge is not objective as it arises from a specific cultural and social location (Shapin, 1995).

The invisibility of scientific embodiment is paralleled by the varying degrees of embodiment experienced by different groups of people. Embodiment reflects the fact that differences in lived experiences based on various characteristics arise due to social factors. Social power regulates the degree to which our bodies are significant. Certain characteristics are marked as “normal” while other characteristics are marked as “other” (Cameron, 2005; Kimmel, 1993). The experiences people have may be rendered invisible based on their experiences of heightened embodiment in relation to the dominant, disembodied groups (Cameron, 2005). No group or individual is permanently disembodied, as advanced age acts as a marker of deviation from the invisible norm (Woodward, 2006). Here we can see social power in operation as groups are divided and ranked by the privileged (Herr, 2004). The privileged have the ability to transcend their embodiment, defining themselves as the norm and unmarked by difference (Pratto, Korchmaros, & Hegarty, 2007).

Perspective influences scientific narrative and adulterates scientific objectivity. For example, scientific narratives can be androcentric in the use of language and metaphor. Feminist scholar Carol Cohn notes discourse about nuclear arms is often replete with phallic and sexual imagery (Cohn, 1996). Beliefs about race and sex have been reproduced in various scientific studies without examination for bias because of the privileged perspective from which they originate. In order to create objectivity, the perspective that generates and interprets information must be understood and acknowledged. Science and the construction of knowledge must be deconstructed to take into account the operation of embodiment (Haraway, 1988).

In fact, postmodern feminist theory notes that only through understanding the specific perspective from which knowledge arises can that knowledge be reliably objective. Recognition of the powerful impact that embodiment has on the generation of knowledge is a crucial component of this concept. Haraway states that “Feminist objectivity is about limited location and situated knowledge...” (1988, p. 583). Traditional scientific objectivity is philosophically an illusion because the scientific process and resulting knowledge cannot transcend its political nature. A “partial perspective” rather than a god-view is created through understanding the mediated nature of scientific knowledge and technological vision. Feminist objectivity generates responsible and relevant knowledge because the concept of situated knowledge takes the relevance of embodiment into account. Haraway encourages use of the subjugated viewpoint in science, a view “from below,” rather than the dominant viewpoint because it is more likely to be critically conscious of hegemonic ways of

knowing (1988, p. 583). She states that “We need the power of modern critical theories of how meanings and bodies get made...” (1988, p. 580). A critical theoretical foundation that takes into account the influence of social power on “objectivity” is necessary because the bright and shining future that the notion of scientific progress promises will only reflect the interest of dominant groups and cultures without it. Postmodern feminism derives its relevance from both the inclusion of diverse perspectives as well as a willingness to continuously be self-critical about its own perspective (Grebowicz, 2005).

Sandra Harding (2006) notes that the practice of critically examining science centers on understanding the interaction between science and culture. Understanding degrees of autonomy and isolation are key elements of critiquing the interaction between science and culture. Harding states that although the sciences are not isolated from culture, they do have more autonomy than other institutions such as law and education. Kuhn’s *The Structure of Scientific Revolutions* (1970) mirrors this idea as it critiques an understanding of science which views scientific knowledge as a linear progression which is isolated from outside influences. Rather, Kuhn argued that revolutions, or paradigm shifts, in scientific knowledge occur. Social and cultural forces influence these paradigm shifts and thus scientific knowledge itself. Kuhn’s argument rejects external objectivity in favor of internal objectivity, which is clearly influenced by human values and interests (Hanna, 2004).

Stereotypes in Advertisements

Embodiment directly influences stereotypes. Myriad notions of masculinity, femininity, races, and types of people are revealed in stereotypes as images of bodies convey different social meanings. Both positive and negative stereotypes reflect systems of social power (Patton, 2001). However, use of stereotypes in media further reflects this power because mass communication has the ability to reach a large audience with limited opportunity for discourse.

Print advertisements utilize social stereotypes because the constraining nature of the medium necessitates depiction of a narrative that can be quickly and easily understood (Cohen-Eliya & Hammer, 2004; Goffman, 1979) Advertisers often draw on specific cultural themes and social stereotypes in order to communicate messages to the consumer about both the target market and the product or service being offered. Accordingly, the meanings derived from visual imagery are culturally variable. Any “visual language” is never unambiguous and universal because it requires frameworks of understanding and interpretation to possess meaning (Kress & Leeuwen, 2006, p. 4). Advertisements may actively assume a self-reflexive position, acknowledging to the reader that they are selling a product and that they are simultaneously expressing social and cultural messages (Pedersen, 2002).

Erving Goffman (1979) argues that displays of masculinity and femininity in advertisements reflect the social structure in which men and women live. Analysis of human figures in advertisements should take into account patterns in the way types of

people are represented, how they are shown interacting with others, and the amount of social power they are shown to possess relative to others (O'Barr, 1994).

Gender and race imagery is particularly prevalent in advertisements containing human figures (Cohen-Eliya & Hammer, 2004). In their examination of race and gender stereotypes of Asian women in advertisements, Kim and Chung (2005) found that women in advertisements are most often White, but racial and ethnic diversity in advertisements is increasing. Visual advertisements containing human figures will typically display messages about masculinity and femininity. Kim and Chung note that women are often portrayed in mass-market advertisements in a manner that displays their bodies for male voyeuristic pleasure. The women's movement may be belittled and images of violence against women are sometimes tolerated if not openly promoted. Marketing strategies are often gendered in that they convey messages about a particular aspect of a product that is masculine or feminine and connect these messages to the status conferred by purchasing that product. Kim and Chung note that companies and corporations may include images of women and people of color in order to portray the company's acceptance of multiculturalism and diverse populations as potential customers. Multicultural advertisements may still support systems of sexism and racism through positioning women and particularly people of color as the "other." The portrayal of racial harmony in advertisements may in fact simply function as a means to expand a company's market share in an increasingly racially diverse society. However, this practice may also obscure problematic global

employment practices that exploit people of color in developing countries and particularly women and children of color in developing countries.

Science as an institution also has a general idealized stereotype. Latour (2000, p. 114) characterizes the mythical image of science as “disinterested scientists gazing over objective entities that they could master at will and they could explain by strictly causal chains.” The public image of science in advertisements focuses on innovation and continued advancement. In her analysis of the advertisements of two prominent biotechnology companies, Hellsten (2002) found that positive images of controlling nature to benefit humanity were common. Additionally, Hellsten found a shift away from portraying mainly White, middle-class, and middle-aged or older people in the advertisements towards portraying younger and more racially diverse people. This shift paralleled advertisement text that encouraged the viewer to look forward to a better future through scientific progress.

Messages about gender and gender roles are evident in medical and scientific advertisements. Social values and concerns are displayed through the imagery and text. For example, an overview of advertisements for psychotropic medications in medical journals reveals anxiety over the increasing amount of political and personal power held by women relative to men (Metzl, 2003). These advertisements created a narrative that connected assumptions about gender with the need for mind-altering medications. Race and class markers provided specific social rank indicators that connected White middle-class women with the need for these drugs. Another study found that advertisements for cardiovascular treatments in medical and cardiovascular

journals underrepresented women (Ahmed, Grace, Stelfox, Tomlinson, & Cheung, 2004). The people in the advertisements in this study were depicted in a specific manner: the women in the advertisements were significantly younger and more racially diverse than the males, who were largely older and White. The bias in this advertisement is particularly problematic as it reinforces the tendency of medical professionals to treat cardiovascular conditions in men more aggressively than in women.

Barbercheck (2001) notes that gender and race stereotypes in advertisements are significant because they depict different roles for different types of people based on social norms and standards. The way in which men and women of different races are portrayed reveals significant information about gender roles and race relations. Advertisements, even those in a scientific publication, utilize culturally based stereotypes. The use of these stereotypes reveals that gender and race are seen as relevant even within the ideally objective and unbiased culture of science. Stereotypes of both scientists and non-scientists alike reveal standards of masculinity and femininity that are informed by race, class, and other factors. The stereotypes in scientific advertisements connect discrimination within the scientific community to discrimination within the broader community through bias, prejudice, and barriers to success based on social status and limited opportunities.

The relationship between advertisements or media images and their interpretation is grounded in interpretative frameworks (Sreberny, 2006). Hall (1997) notes that meanings in media must be actively decoded according to a cultural

framework of understanding; meaning-making is less a process of translation and dialogue. Ging (2005) notes that neither hypodermic needle theories, which assert direct media influence upon an audience, and some active audience theories, which assert audience resistance to media messages, fully capture the relationship between media messages and an audience. Ging states that an individual's interpretation of, acceptance of or resistance to gender narratives presented in the media varies according to the wider gender scripts. Similarly, Abercrombie and Longhurst (1998) support active audience theory, as they note that individuals use learned ways of thinking to understand, and possibly contest, the messages that are sent to them. Audiences and individuals have the capacity to resist or incorporate messages voluntarily.

Gender and Race in Scientific Practice and Theory

A person's ranking in society according to meaningful social characteristics affects the general amount of social power he or she holds. As such, this rank affects how well a person's needs are met by social institutions (Johnson, 2001). Western science as an institution has reflected a specific cultural understanding of men and women in both its practice and theory (Bleier, 1988). The gender norms that organize the social world are certainly present in scientific understanding of the natural world (E. F. Keller, 2001). Feminists noted that the pursuit of knowledge of the natural world often adhered to the assumption that nature is organized into dichotomous and hierarchical relationships, which reflected the social system that separated and ranked

categories such as, for example, male/female, reason/feeling, and objective/subjective (E. F. Keller, 2001; Shiva, 1996; Twine, 2001).

Current stereotypical images of scientists in the United States closely mirror systems of privilege in society. As a practice and profession White males dominate science in analysis of the stereotypes. The pervasiveness of this stereotype is often measured by the “draw-a-scientist-test” (DAST) as designed by Chambers (Chambers, 1983). The DAST, wherein students are asked to draw a typical scientist, is usually assessed in terms of stereotypical scientist markers such as sex, race, age, setting, and appearance. The DAST has been conducted using participants of varying ages and backgrounds, although it is usually administered to school-age children (Thomas, Henley, & Snell, 2006). The conventional markings of a scientist such as a laboratory coat, glasses, beakers or test tubes, and crazy hair are often present (Purbrick, 1997).

The gendered nature of science in stereotypes is demonstrated in the DAST; through it, science is conceptually defined as a masculine pursuit. Results from the DAST consistently indicate that both male and female participants depict scientists as male (Purbrick, 1997). This trend holds true both for children and adults. Among college-age students of science the use of the male stereotype by both males and females persisted (Thomas et al., 2006). Even adult practicing scientists most often depicted male scientists in the DAST (Bowtell, 1996). The repeated and continued use of the male scientist stereotype is particularly significant in terms of its possible influence on the scientific research and career pool. Widespread use of the male

scientist stereotype may negatively impact public views of science and discourage girls from pursuing it as a career (Schibeci, 2006).

Some researchers call into question the validity of the DAST by suggesting that children intentionally use the stereotype rather than their own personal concept of a scientist in order to follow the directions (Symington & Spurling, 1990; Thomas et al., 2006). Although it is possible that participants may choose to depict the male scientist stereotype rather than a personal image of the typical scientist, the pervasive use of male imagery demonstrates the gendered nature of science. The close association of the professional pursuit of scientific knowledge with specific demographic characteristics reveals flaws in the objectivity of science.

Science as a knowledge system is highly valued not only for the real benefits it has given to society in terms of information and standards of living but also for its perceived value neutrality and universality (Shiva, 1996). However, science is intertwined with power relations in its concepts and methods (Gouws, 1996). Feminist critics of science react against the invisible assumptions and foundations of scientific theory and inquiry that are biased due to their patriarchal roots (Clough, 2004). The social ranking of femininity and masculinity has been applied to science. Possession of scientific knowledge is closely associated with masculine rationality. In contrast, nature is associated with femininity and irrationality. A dichotomous view of masculine/feminine and culture/nature is formed; masculinity and culture operate to control the feminine and nature (Balinisteanu, 2007; Braidotti, 2007; Waniek, 2005). The practice of science has been constructed to reflect typically “masculine” traits and

values such as objectivity and rationality (D. M. Hughes, 1991). The mechanistic view of nature, that it is a machine or nature that can be harnessed or controlled by use of intellect and reason marks science as a masculine activity (L. S. Keller, 1992). The system of patriarchy characterizing Western societies has not historically favoured the inclusion of women in scientific practice, as women historically have been regarded as irrational. In this way women have been closely associated with the “nature” that science aims to control and dominate (Shiva, 1996).

Career achievement within science and academia is structured along race and gender lines. As early as 1929 it was recognized that few women who taught at universities had attained full professorship and were restricted to specific areas of study as a result of their gender (Rossiter, 1982). Currently the National Science Foundation reports that women in academia are generally disadvantaged compared to men. Specifically, “Women faculty earn less, are promoted less frequently to senior academic ranks, and publish less frequently than their male counterparts” (2003, p. 1) . Although women are employed in academic science, they are most often found in less prestigious and non-tenured positions (Bebbington, 2002). Gender, along with age, is associated with occupational roles and responsibilities. Accordingly, there is considerable association between sex and earnings in employment. Occupations that are dominated by women receive lower compensation than those dominated by men (Reskin & Bielby, 2005). Pay inequality similarly extends into higher education, as the more women present in a college major relative to men, the lower the pay in the career fields associated with that major (Roska, 2005).

Women and men may also work in different styles when conducting research. A 1995 study of 200 scientists who had received NSF grants generally showed that while men tended to seek out power, focus on career advancement, and work within a field at the forefront, women tended to be less concerned with power, focus less on career advancement, and seek out an unoccupied subfield while emphasizing detailed work (Luckenbill-Edds, 2002). The social value that is placed on different work styles directly influences individual career achievement as well as peer recognition.

Feminist scholars argue that factors other than innate sex-based cognitive abilities or lack of interest are to blame for the disparity between men's and women's participation in science (Jaffe, 1995; Zuckerman, 2001). Because science has been understood to be a primarily masculine pursuit, women's participation in science has been limited. The limitations may arise from lack of interest or motivation or from intentional or unintentional discrimination, or a combination of both factors (Luckenbill-Edds, 2002). Hubbard (2001) notes that the expert knowledge needed to conduct scientific research requires graduate and post-graduate education, which has been most widely available to White, middle- and upper-class males in Western society. Women and people of color have had increased opportunities to participate in higher education and science in recent years. However, women participate in scientific fields during their formal education at lower levels than men. Hubbard also notes that women are also more likely to halt their scientific education. Accordingly, they are less likely than men to receive doctorates in scientific fields and they are less likely than men to become scientists and remain employed in scientific fields and

academic positions. Budden et al. (2008) found that publishing is affected by discriminatory practices, as the introduction of double-blind peer review in the journal *Behavioral Ecology* increased the proportion of female first-author females by 7.9% without a corresponding increase in the number of women in the field.

The pattern of underrepresentation of women in science, technology, engineering, and mathematics as education and career paths advance is known as the “leaky pipeline” (Blickenstaff, 2005). The leaky pipeline is connected to gendered ideas and practices in both education and society (Jacobs, 1996). Beliefs about gender roles and self-perception of academic aptitude also play a role in participation in the sciences (Kinzie, 2007). The leaky pipeline phenomenon is even more evident in studies of non-White Western populations because they tend to not study the sciences as often as White students (Wickware, 1997). Although in the United States women are now the majority of college students, many more men than women are enrolled in science, technology, and engineering programs (Kinzie, 2007). The structure of scientific education may better reflect the needs and social background of White male students more than students of color because White males are statistically more likely to be equipped with the social support systems and academic role models that encourage educational achievement. Additionally, they are more likely to make a clear connection between completion of scientific study and engagement in a scientific career due to the clear presence of a role model in their personal or academic lives (Luckenbill-Edds, 2002; Wickware, 1997). Women suffer from a lack of suitable mentors, which serves to further academic professional achievement structured by

gender (G. Hughes, 2001). Women of all races may be further restricted in their potential for career achievement due to the general learned tendency to work collaboratively towards a goal, rather than employing the strategy of outright individual competition that is fostered within scientific education (Wickware, 1997). The structure of scientific education, particularly introductory courses, leads to discrimination that stands in stark contrast to the impartial and nondiscriminatory veneer of science.

The leaky pipeline theory does not fully capture the patterns of women's participation in science (Blickenstaff, 2005; Dancy, 2004; Kulis, Sicotte, & Collins, 2002; Settles, Cortina, Malley, & Stewart, 2006; Sonnert, 1995). Dancy (2004) argues that the analogy of the leaky pipeline obscures the patriarchal nature of scientific enterprise itself. It is not an education and career system that simply needs a few adjustments, including increased mentoring, in order to provide open and fair participation by all social groups. Rather, the system is founded on principles of bias. The construction of scientific practice as distinct from social forces can have a very real effect on the lives of women as they face significant challenges to success on personal and public levels. Individual acts of discrimination may be decreasing, but gender bias has been built into the system. The leaky pipeline theory must be recognized as complex and multifaceted; accordingly, no simple solution will effectively solve the problem of underrepresentation of women in science, technology, engineering, and mathematics. Although a weakness of the leaky pipeline theory is that it oversimplifies factors that influence participation in these fields, educators do

have a powerful opportunity to foster scientific talent in both men and women (Blickenstaff, 2005).

The organization of science as a practice directly influences career outcomes and experiences (Bebbington, 2002). In contrast to the leaky pipeline theory, deficits theory posits that the structure of the scientific environment is primarily responsible for the difference between the career success and experiences of men and women (Sonnert, 1995). Deficits theory as presented by Settles, Cortina, Malley, and Steward (2006) directly connects career outcomes to both formal and informal features of scientific practice. In this way formal structural barriers to success such as discrimination and informal challenges such as limited networking opportunities negatively impact career patterns. In the same way formal and informal mechanisms can contribute to career success. Settles, Cortina, Malley, and Steward found that organizational changes in the scientific workplace that support positive career experiences would likely promote career success and more equitable participation in academic science. Difference theory as presented by Sonnert (1995) proposes that women in science have a different outlook on work than men. Women's career goals, which are influenced by socialization and cultural values, affect their ambitions and assertiveness. The deficiency theory and the difference theory are not mutually exclusive.

Feminists highlight the social roots of inequalities in science because science has contributed to social inequalities through biased theory and research. The scientific endeavors of White men have been most valued historically (Bridglall &

Gordon, 2004). The culture of science and therefore science as an institution has been structured to best serve men (Schiebinger, 2004).

The Committee on Science, Engineering and Public Policy, which is affiliated with the National Academy of Sciences notes that the lack of full participation by women and people of color in science and engineering is problematic because it restricts the available talent and potential scientific progress (2006). It also tends to reproduce existing power structures, meaning that women and people of color will continue to be at a disadvantage and that the aims of scientific inquiry will not reflect diversity (Luckenbill-Edds, 2002). Furthermore, scientific fields contribute significantly to the economy. The lack of full participation in the sciences by both men and women may threaten these fields and subsequently undermine effective economic competition (Bettinger & Long, 2005). The United States must possess a racially diverse scientific workforce in order to be competitive and productive internationally.

Summary

In postmodern feminism the powerful influence of social forces on knowledge is fully taken into account for groups and the individual. Furthermore, it creates a space from which the overlooked perspectives of the disadvantaged can be explored. The individual perspective, as well as experience, is linked directly to degree of embodiment. In contrast, a false veneer of disembodiment and objectivity marks scientific theory and perspective. Embodiment and disembodiment are socially constructed through cultural norms and practices. Individual embodiment and

knowledge must be deconstructed in order to examine social inequality and the impossibility of pure objectivity. Understanding the location from which embodiment is experienced and from which knowledge is constructed is key to this deconstruction.

Gender and race stereotypes reveal various social biases and social privileges. Postmodern feminism provides a theoretical perspective that is able to explore the use of social stereotypes in scientific advertisements through recognition of the influence of social location and embodiment. The bodies portrayed in advertisements are intended to convey social meaning quickly, generally without the need for an accompanying narrative. In this respect, the stereotypes in advertisements are utilitarian. Although there are certainly positive and negative implications for stereotypes, a postmodern feminist analysis of their usage must fundamentally focus on the social implications of embodiment patterns. The underlying bias in the use of all stereotypes that invisibly privileges certain groups while naturalizing social relations provides insight to social inequalities.

The stereotypical image of a scientist as a man in a white lab coat surrounded by beakers and test tubes persists. As science is ideally understood as unbiased and objective, the gender and race inequalities in this stereotype are constructed as normal. Similarly, bias and subjectivity in actual scientific theory and practice are rendered invisible. Gender and race inequality, as well as other inequalities, are mirrored in scientific assumptions that privilege certain groups and ideas.

Social status impacts scientific achievements. White men generally have greater success in their scientific careers than do women or people of color. This

disparity likely arises through individual decisions related to gender roles and structural barriers to full and equal participation in scientific research and practice. Underlying these causes are the general systems of patriarchy and racism that privilege White men.

Lack of full participation of men and women of all races is likely to hinder both scientific endeavors and the overall economic prosperity in the United States. Additionally it is problematic that the ideally objective theory and practice of science continues to be marked by social inequalities. Recognition of the impact that social inequalities have upon scientific knowledge is necessary in order to challenge systematic social inequalities and to obtain scientific knowledge that is more objective.

METHODS

This chapter discusses the research methodology and the theoretical perspective of this study. It provides detailed definitions of the various data categories utilized. The process of gathering and analyzing data is described. The manners in which these methods differ from and expand upon Barbercheck's methodology are explained.

Hypothesis

It is hypothesized that the use of negative gender and race stereotypes by advertisers has decreased between the time periods 1995 through 1997 and 2004 through 2006. Racial diversity and a proportionate depiction of males and females are likely to have increased between these time periods.

Research Perspective

The purpose of this study was to note qualitative and quantitative depiction of sex and race within advertisements in *Science* in order to examine the associated gender and race stereotypes. Postmodern feminism was selected as the primary theoretical foundation because it directly connects the creation of scientific knowledge with social actors. Postmodern feminism calls for a semiotic analysis that scrutinizes claims to objectivity. In this study it provided a means of recognizing and analyzing the visual symbolism in the advertisements while taking into account the context in which the advertisements appeared. Lastly, the emphasis of identification of bias

within an apparently neutral or objective context was particularly fitting for this analysis of stereotype usage in advertisements.

Hammers and Brown (2004) note that postmodern feminism rejects metanarratives or grand narratives as they are too absolute and do not fully recognize contextualized knowledge. This includes the metanarrative of continual scientific progress through complete objectivity (Shapin, 1995). However, Williams and Sewpaul (2004) state that metanarratives that specifically take into account the larger social, political and historical context are acceptable in postmodern feminism because they are holistic and relational rather than totalizing and essentialist. Postmodernism also rejects essentialist and universal notions of identity. Baez (2004) asserts that race is an essentialist category marked by reductionism. In order to make effective use of narrowly defined identities, a study must “recognize its own power in (re)producing group and individual differences” (Baez, 2004, p. 300). This study’s use of gender, race and identity categories adheres to Baez’s claim that a study must examine difference by examining how it is used and to what effect, rather than naturalize it. However, this study does make use of relatively fixed identity categories.

Research Design

Advertisements in the 2004 through 2006 print issues of *Science* were examined in terms of the sex, race, and additional identifying characteristics of the individuals featured in the pictorial advertisements. Individual advertisements in this time period greater than one third of a page were examined in detail based on

Barbercheck's original categories. As initially stated by Barbercheck (2001), these categories were:

1) issue type: normal or with special focus/advertising supplement aimed at minorities or women; (2) people: with or without people in the same picture; (3) profession: scientist or not scientist; (4) sex: male, female or both in the same picture; (5) race: white, African American, Asian, other or more than one race in the same picture; (6) image: authority/expert, athlete, "nerd"/nonconformist, or other; and (7) special qualities: the words *easy/simple* or *efficient/fast/reliable* emphasized in font size larger than bulk text (p. 120).

The methodology used by Barbercheck to analyze the special qualities was inconsistent as she stated that she tracked the words *efficient/fast/reliable* but provided results for the words *fast/reliable/accurate* (2001, p. 124). This study tracks use of the words *efficient/fast/reliable/accurate*.

In this study the research design was expanded in order to provide a more detailed analysis. To most effectively expand upon the information provided in Barbercheck's study, additional subcategories were included in this study. Category 1, issue type, was expanded to refer to both issue type and advertisement type. The identity of the advertiser was noted in order to determine advertiser affiliation. Advertisements placed by the American Association for the Advancement of Science, or AAAS, were noted because this organization publishes *Science*. Through this process, advertisements published by AAAS were contrasted with advertisements not placed by AAAS. The sixth category, image, included the new subcategory of caregiver. In this category it was noted if there was a caregiver for a child present in the advertisement. The sex of the caregiver was also noted.

Data Collection

The advertisements in all print issues of the journal *Science* published from January 2004 through December 2006 were examined. In total 154 individual issues were reviewed¹. In accordance with Barbercheck's methodology, only those advertisements sized greater than one third of one page were included in the detailed analysis. Within the included 154 issues published in this time period there were 4,536 advertisements that met this condition. Of these advertisements, 1,809 were included in the detailed analysis as they featured one or more human figures identifiable as either male or female.

A spreadsheet was used to track all data within these categories for each advertisement in the order in which they occurred every time they appeared. In this way a complete record of all appropriately sized advertisements was kept. As in Barbercheck's study, all appropriately sized advertisements were coded every time they occurred despite the number of times they appeared throughout the issues. In this way many identical advertisements were analyzed multiple times. Including all advertisements despite multiple reoccurrences of specific advertisements allows the gender, race, and identity themes that were portrayed to be most accurately assessed.

Categories of Analysis

This study adhered to the categories of analysis as laid out by Barbercheck (2001) as closely as possible. The precise use of Barbercheck's categories is

¹ Barbercheck stated that her study reviewed all issues of *Science* in the calendar years 1995 through 1997, or 141 issues. However, AAAS published 153 issues of *Science* during that time period.

necessary to conduct an accurate comparative analysis of race, sex, and identity in the advertisements in *Science* over time.

Issue or Advertisement Type

Barbercheck (2001) sorted the 1995 through 1997 advertisements into two types based on the type of issue they appeared in: regular or special. Barbercheck assessed the issue type independently of AAAS's use of the term "special issue," which signifies an editorial decision to focus on a specific topic or field of study within an issue. Rather, Barbercheck used "special issue" in a unique manner to denote an issue that either contains an editorial focus or an advertising section or supplement that centers on women or people of color.

The 2004 through 2006 issues of *Science* were likewise sorted according to issue type and the advertisements within them were analyzed according to which type of issue they were published in. Determining an issue's type was a straightforward process. An issue was deemed special based on its noted editorial focus or by the presence of an appropriate supplemental advertising section. All issues not categorized as special were classified as regular issues.

In addition to categorizing advertisements according to the issue type they appeared in, advertisements in the 2004 through 2006 issues were also identified as AAAS advertisements or non-AAAS advertisements. As such, advertisements were identified as either placed by AAAS or as placed by any company or organization not directly related to AAAS.

The purpose of analysis advertisement affiliation was to identify the difference between the practices of scientific media and general advertisers in their advertising strategies. This supplemental category provides valuable information about the way stereotypes are used by different groups in scientific advertisements. AAAS advertisements largely focus on promoting *Science* itself as well as AAAS events, meetings and awards. AAAS advertisements appear in both regular and special issues. Special editorial articles were not counted as advertisements. In contrast to the other advertisements published in *Science*, AAAS advertisements more closely reflect the editors' public views of scientists and science. The manner in which AAAS publicly chooses to present science and scientists in its advertisements communicates information both about the way it views scientists and the way it views the readers of *Science*. By contrasting AAAS advertisements with the advertisements placed by companies and groups not affiliated with *Science*, the point of view of AAAS as an official distributor of scientific news and research can be exposed.

People

In Barbercheck's (2001) study of the 1995 through 1997 advertisements in *Science*, only advertisements containing human beings were included in detailed analysis. Furthermore these human beings had to display discernable gender and racial characteristics. An image of a human being was eligible for analysis even if it only contained a small part of the body as long as it met these criteria.

These criteria were also used in analyzing the 2004 through 2006 issues. However, individuals who clearly appeared to be either male or female but were

lacking a distinct racial identity were also included. Including these individuals permitted a complete analysis of sex and gender as presented in the advertisements. Individuals without distinct sex were excluded from the analysis; therefore, more advertisements appeared that displayed human figures than were included in the detailed analysis. Advertisements showing only part of a body, such as a hand, were included if the sex was clearly indicated. Cartoon figures and other illustrations were included in the analysis if appropriate.

Profession

Barbercheck (2001) categorized human figures in the 1995 through 1997 advertisements into two broad categories: scientist or non-scientist. Scientists were identified by dress and activity. Scientists appeared in scientific garb including lab coats. Scientists also appeared interacting with complex scientific equipment or conducting research in a laboratory setting.

In the 2004 through 2006, advertisements depicting scientists and non-scientists were also noted. Scientists had to meet certain criteria in order to be classified as such. First of all, an individual wearing specific types of clothing and equipment was clearly identified as a scientist. This clothing and equipment such as lab coats, safety glasses, and stethoscopes obviously indicates engagement in scientific activity. The absence of such signifiers did not automatically exclude an individual from the scientist category.

A second criterion was direct participation in scientific research or study. Individuals shown operating specialized scientific equipment or working in a

laboratory were identified as scientists. All medical personnel were classified as scientists.

A third indication of scientist status was direct identification of the individual as a scientist through text as the person was named and an achieved degree, a degree in progress, or a special award he or she had received was noted. Individual scientists identified through their name, education level, or award achievements were often missing other scientist indicators such as specific clothing and equipment.

A fourth method of identifying scientists was the act of reading *Science* itself. Many advertisements placed by AAAS often portrayed individuals reading *Science*. As these advertisements were plainly constructed by AAAS to appeal directly to scientists on a personal level, those individuals portrayed reading *Science* were counted as scientists. However, close proximity to an issue of *Science* or the AAAS website did not automatically indicate scientist status if the individual shown was lacking other scientist indicators.

A fifth characteristic of scientist status was often found in advertisements featuring employment opportunities. These advertisements sometimes featured an individual who in appearance, setting, or activity did not appear to be a scientist. However if these advertisements featured a textual declaration that closely affiliated the individual shown with professional scientific practice, such as “I want to influence change,” the individual was classified as a scientist.

Finally, historically notable scientists were portrayed in many advertisements. These highly recognizable individuals were classified as scientists even if the above scientist markers were absent.

Sex

In both the 1995 through 1997 issues and the 2004 through 2006 issues, individuals were classified according to sex. In order for an advertisement to be included in the detailed analysis the human figures portrayed had to be clearly identifiable as male or female. Both photographed and illustrated males and females were included. Most adults appearing in advertisements appeared to be either male or female, save some advertisements that featured only partial body parts.

Several advertisements featuring babies were excluded from the detailed analysis due to the lack of sex indication. However, most babies featured in the advertisements appeared to be clearly male or female based on the clothing they were wearing.

Race

Barbercheck (2001) used four general categories of race in her 1995 through 1997 analysis of *Science*: White, African American, Asian American, and Other. These broad categories effectively capture the information necessary to analyze trends in racial depiction in scientific advertisements. As advertisements cannot provide a personal detailed racial or ethnic history of the individuals shown, use of broad racial categories is necessary. These four categories allow the overall racial composition of the individuals portrayed to emerge.

These four basic categories were also used in the 2004 through 2006 analysis of the advertisements in *Science*. In this analysis inclusion in a racial category was based solely on perceived physical characteristics underlying a shared ancestry rather than ethnic affiliation based on shared culture. This direct approach was most appropriate for the analysis due to the broad and simplified manner in which it was necessary to classify individuals.

Although Barbercheck's (2001) original terminology will be used, it should be noted that many individuals did not technically appear to be American based on the setting in which they appeared. Therefore individuals classified as African American or Asian American are more properly thought of as being of African descent and of Asian descent, respectively.

In order to clearly classify an individual's race it was necessary to restrict racial definitions to general areas of the world. White individuals appeared to be of European descent and possessed light skin color. African American individuals appeared to be of African descent. Asian American individuals appeared to have ancestral roots in East Asia, Southeast Asia, or the Indian Subcontinent. Individuals of racial descent other than White, African American, or Asian American did not appear to be clearly descended from these above areas of the world and were categorized as "Other." Although these racial categories do not fully capture the full diversity of human ethnicity nor do they adequately acknowledge mixed-race ancestry, they permit an effective investigation into the way in which several significant social

and racial groups are represented in scientific advertisements in an American publication.

Identity

Barbercheck (2001) utilized four additional categories to classify the way in which individuals in the 1995 through 1997 issues were depicted. In the 2004 through 2006 advertisements individuals in advertisements were again categorized according to their appearance and activities in the method originated by Barbercheck. Through these categories, information about an individual's identity beyond his or her race, sex, and scientist status was identified. These categories were authority/expert, athlete, "nerd"/nonconformist or other. Individuals not included in the categories of authority/expert, athlete or "nerd"/nonconformist were simply included in the "other" category by default. In this study the additional subcategory of caretaker is also included in order to provide further details about stereotypes in the advertisements.

The Scientist as Hero, Authority, or Expert

Barbercheck's notion of the scientific hero, authority, or expert referred explicitly to scientific knowledge and practice. Furthermore the hero, authority, or expert was not a scientist simply shown engaged in the rote, day-to-day scientific activity; rather individuals classified as such were featured in advertisements that created a noble and polished picture of science. An element of the great magnificence of scientific knowledge and achievement was often injected into the advertisements featuring heroes, authorities, or experts in science.

Scientific heroes, authorities, and experts were often portrayed in 2004 through 2006. These individuals appeared in advertisements that usually contained stylistic elements indicating the important place that science and scientists hold in society. These advertisements were frequently carefully composed with artistic flair including notable visual elements such as dramatic lighting as well as illustrations of recognizable scientific subjects such as molecules or DNA strands. Scientists awarded prizes for their achievement were repeatedly portrayed in these advertisements. Historically distinguished scientists were categorized as heroes, authorities, or experts as their images were held up to readers as examples to follow in order to achieve scientific greatness. The text in advertisements featuring heroes, authorities, or experts often underscored the great value inherent in science both for the contributions made to scientific knowledge and to the great benefit it can provide to the public.

Athletes

Athletes in Barbercheck's (2001) analysis those individuals that were shown engaged in strenuous recreational physical activity. This activity was often competitive in nature.

Individuals engaged in sport or exercise were categorized as athletes. However in 2004 through 2006 the categories of scientist and athlete were not mutually exclusive, as a reoccurring advertisement depicted a scientist reading *Science* while riding a ski lift. Often classification of an individual as an athlete was straightforward due to the traditionally "sporty" nature of the activity featured. For example, classically athletic activities such as boxing, playing football, or rock-climbing were

shown. Competition against others, nature, or against one's self was often an important element in depiction of athletes. Individuals engaged in vigorous physical activity classified as athletes.

“Nerds” and Nonconformists

Barbercheck identified “nerds” and nonconformists largely through their appearance rather than through the activities in which they were engaged. A “nerd” or nonconformist was a type of scientist that was disconnected from the social norm otherwise generally adhered to by non-scientists. Specifically, a “nerd” was identified by the fact that he or she—usually he—did not appear to be familiar with standards of socially acceptable appearance or behavior. The personal grooming skills of a “nerd” often appeared to be lacking and he or she was sometimes shown as an individual too wrapped up in and passionate about scientific work. The nonconformist, on the other hand, was shown as a scientist who was aware of social standards of dress and conduct but chooses to disregard them. This individual was often a “rebel” scientist (Barbercheck, 2001).

In the 2004 through 2006 issues of *Science*, scientists were again occasionally depicted as “nerds” and nonconformists. This image category, although quite subjective and historically variable, was nonetheless very important as it refers to a prominent scientific social stereotype. Furthermore the “nerd” or nonconformist is a familiar and well-understood stereotype to both scientist and non-scientist alike. “Nerds” and nonconformists in the advertisements appeared as two sides of the same coin: they are both a type of individual deeply involved in science who also defies

social norms to varying degrees. The “nerd” often appears somewhat unkempt, with mussed-up hair. Alternatively the “nerd” may appear squeaky-clean in a lab coat complete with pens in pocket. The “nerd” usually appears in carefully constructed advertisements that depict a somewhat socially inept individual as evidenced by the somewhat awkward facial expression and body language. “Nerds” seem to be unable to embrace the appearance and behavior standards set by society. In contrast the nonconformist scientist appears fully aware of social and scientific social norms but chooses to embrace science as an alternative lifestyle.

Caregivers

A new category, Caregiver, was introduced. This category allows further details regarding gender and race stereotypes to emerge.

A caregiver was an adult individual who appeared to be directly involved in the care of a child. Medical professionals were included in this category if appropriate. The sex and race of the caregiver was noted, providing information about stereotypes of individuals involved in childcare.

Special Qualities

Barbercheck (2001) noted trends in the text of advertisements in order to establish how the messages sent by the text were associated with the various characteristics of the individuals displayed in the 1995 through 1997 advertisements in *Science*. Specifically, for advertisements of the appropriate size that displayed individuals with identifiable sex and race characteristics, she noted when the words *easy* or *simple* appeared. Barbercheck also variably tracked the words

efficient/fast/reliable and *reliable/fast/accurate*. In this study including an analysis of the words *efficient/fast/reliable/accurate* will rectify this inconsistency as much as possible. In order for advertisements to be included in the detailed analysis these words had to appear in a font size larger than the other text in the advertisement.

Advertisements in the 2004 through 2006 issues of science were also analyzed in terms of the words *easy/simple* or *efficient/fast/reliable/accurate* if these advertisements met the appropriate size, human figure, and font size requirements. There were generally three font sizes used in the text of the advertisements. These sizes were heading, subheading, and general. The headline text was largest and focused on grabbing the reader's attention. As in Barbercheck's analysis, in the 2004 through 2006 advertisements the larger text was included in the special qualities analysis. Restricting analysis to this text size most accurately reflected the advertiser's condensed message to the reader. The subheading text was slightly smaller than the heading text and functioned to elaborate slightly on the information provided in the heading. The general text was the smallest size font. It provided more details about the product or service offered in the advertisement.

Statistical Analysis

In order to clearly compare and contrast the data in the two time periods, standard mathematical calculations were used in the form of descriptive statistics.

Barbercheck's (2001) original study focused on analysis of advertisements rather than an analysis of the individuals depicted in those advertisements. The advertisements were categorized as either depicting only males, only females, or both

males and females. The analysis focused on determining how stereotypes were depicted within each of these categories. This study also compared advertisements in this manner. However, this study included an analysis of both advertisements compared to one another as well as an analysis of the individuals depicted in the advertisements. Analysis of the individuals in the advertisements provides additional information about the use of stereotypes.

Qualitative Analysis

Like Barbercheck's (2001) study, this study included a qualitative analysis of selected advertisements. As a supplement to the quantitative analysis, the qualitative analysis serves to demonstrate specific instances of notable use of stereotypes and themes that were not captured in the quantitative analysis. Description of the selected advertisements provides information about the various social and cultural messages communicated through the text and imagery.

Limitations

Although bias is unavoidable, an axiomatic analysis of the advertisements allows the advertisement's significance to emerge unhindered. As advertisements were constructed in order to convey meaning to the reader there is a clear message behind each element of the advertisement. In order to code the advertisements in the most clear and straightforward manner possible, inclusion in each of the categories was based solely upon the advertiser's intended message to the reader/consumer. Advertisements were consistently analyzed only in terms of the apparent visual and textual cues. Although there is certainly a measure of subjectivity and bias when

identifying and classifying characteristics as presented in the advertisements, use of Barbercheck's (2001) classification process limits subjectivity. Objectivity would further be enhanced through a second opinion; inter-coder reliability is unfortunately absent.

The most socially and ethically significant data limitation relates to the complex issue of racial identification. As the individuals appearing in the advertisements are unable to self-identify their own unique racial and ethnic heritage, it was necessary to rely on broad racial categories in order to conduct an analysis of race. Although this method is imperfect, the issue of race in advertising must not be omitted from the analysis.

An axiomatic approach to the advertisements was most often necessary in this category. Because the advertisement designers can compose the advertisement and the individuals pictured in any number of ways, the portrayal of different races was analyzed as if the apparent race of all individuals selected to appear in the advertisements was a deliberate and conscious choice. For example, the racial ancestry of an individual is sometimes not obvious and many individuals may possibly be of mixed ancestry. However, in this analysis, if an individual's race was not immediately apparent, then the most likely racial categorization was used. Although the unique ethnic history of each individual depicted is not captured in this method of analysis, the intended message of the advertisement is apparent through the composition choices made by the advertisement designers.

My own personal subjectivity and bias is inescapable, but must be recognized as a limiting factor in this study. Postmodern feminism calls for an examination of the perspective from which knowledge originates; accordingly, that principle applies to this study. My own perspective directly affects my understanding of stereotypes. As a White, middle-class woman, my background and experiences have influenced the way I view and understand the world. Most notably my social power insulates me from racism but not necessarily racist modes of thinking about and viewing the world. My identity grants me membership in socially privileged groups. I experience systematic privilege in my life because members of my race dominate social institutions; these institutions that guide my life experiences are designed to meet my needs (Johnson, 2001). Although I have attempted to conduct this study without systematic bias, my privileged perspective must be acknowledged as a clear source of partiality and prejudice. Only by fully acknowledging my own privilege and bias can this study present a perspective from which to validly identify and explore stereotypes in the advertisements in *Science*.

Summary

This chapter detailed the ways in which this study collected and applied data. The synthesis of the original means of data collection and analysis with the new categories and analytical techniques was established. The new aspects of the methodology were intended to provide more detailed and focused information. Usage of both qualitative and quantitative means of analysis provided the structure for a

comprehensive analysis of stereotypes. Through this methodology the significance of social and cultural stereotypes in advertisements in *Science* was explored.

RESULTS

From January 2004 through December 2006, 154 issues of *Science* were published: 17 special issues and 137 regular issues. These contained 4,536 advertisements larger than one third of a page. Of these advertisements, 1,809 (40%) contained a human figure with a discernible sex, or 1,604 (89%) in the regular issues and 205 (11%) in the special issues. Of this total of 1809 advertisements, 472 (26%) were associated with AAAS or *Science*. Advertisements not associated with AAAS totaled 1,337 (74%). Each individual advertisement that met the requirements was included in the analysis each time it appeared, regardless of the number of times it appeared.

Single-Sex and Mixed-Sex Advertisement Distribution

Advertisements depicting only males were most numerous overall at 43% of the total advertisements compared to 24% of the advertisements showing only females and 32% of the advertisements showing both males and females (see Table 1). AAAS advertisements portrayed male-only advertisements often, at 54% percent of the total advertisements. Mixed-sex advertisements generally appeared more often than female-only advertisements, although this was not the case in special issues.

Table 1: Single-Sex and Mixed-Sex Advertisements in *Science*, 2004-2006

	All Advertisements (n= 1809)		Advertisements in Regular Issues (n= 1604)		Advertisements in Special Issues (n=205)		AAAS Advertisements (n= 472)		Non-AAAS Advertisements (n=1337)	
	#	%	#	%	#	%	#	%	#	%
Male-Only	781	43%	695	43%	86	42%	257	54%	524	39%
Female-Only	443	24%	376	23%	67	33%	99	21%	344	26%
Mixed-Sex	585	32%	533	33%	52	25%	116	25%	469	35%

In 1995 through 1997 male-only advertisements were most numerous in regular issues (see Table 2). Mixed-sex advertisements were most numerous in special issues. The proportion of female-only advertisements remained fairly consistent in regular and special issues. Advertisements in 1995 through 1997 had dramatic shifts in the number of male-only and mixed-sex advertisements in regular and special issues compared to the 2004 through 2006 advertisements. Male-only advertisements in regular issues appeared more often in regular issues and less often in special issues in 1995 through 1997 compared to 2004 through 2006.

Table 2: Single-Sex and Mixed-Sex Advertisements in *Science*, 1995-1997

	All Advertisements (n=1094)		Advertisements in Regular Issues (n=832)		Advertisements in Special Issues (n=262)	
	#	%	#	%	#	%
Male-Only	608	55.6%	528	63.5%	80	30.5%
Female-Only	321	29.3%	247	29.7%	74	28.2%
Mixed-Sex	165	15.1%	57	6.8%	108	41.2%

Source: Barbercheck 2001, pp. 120-121

In 2004 through 2006 male-only and female-only advertisements prominently featured only Whites, at 82% of the male-only advertisements and 75% of the female-only advertisements overall (see Table 3). Female-only advertisements depicted more non-Whites of a single race than did male-only advertisements. Mixed-sex advertisements featuring a single non-White race were rare. Overall 73% of the mixed-sex advertisements depicted more than one race, although White-only groups also appeared frequently.

Table 3: Race Distribution in Male-Only, Female-Only, and Mixed-Sex Advertisements in *Science*, 2004-2006

			White	African American	Asian American	Other	Multiple Races
All Advertisements	Male-Only	(n=781)	82%	5%	6%	4%	3%
	Female-Only	(n=443)	75%	8%	12%	2%	3%
	Mixed-Sex	(n=585)	25%	0%	0%	2%	73%
Regular Issues	Male-Only	(n=695)	82%	5%	6%	4%	3%
	Female-Only	(n=376)	76%	7%	12%	2%	3%
	Mixed-Sex	(n=533)	24%	0%	0%	2%	74%
Special Issues	Male-Only	(n=86)	80%	7%	8%	4%	1%
	Female-Only	(n=67)	63%	16%	13%	5%	3%
	Mixed-Sex	(n=52)	33%	0%	0%	0%	67%
AAAS Issues	Male-Only	(n=257)	87%	5%	5%	1%	2%
	Female-Only	(n=99)	69%	8%	15%	6%	2%
	Mixed-Sex	(n=116)	20%	0%	0%	0%	80%
Non-AAAS Issues	Male-Only	(n=524)	79%	5%	7%	6%	3%
	Female-Only	(n=344)	75%	9%	11%	1%	4%
	Mixed-Sex	(n=469)	26%	0%	0%	2%	72%

As in 2004 through 2006, in 1995 through 1997 male-only and female-only advertisements frequently depicted Whites (see Table 4). Again, female-only advertisements generally depicted more non-Whites of a single race than male-only advertisements. Additionally, in both time periods mixed-sex advertisements featured more than one race most often, as well as only Whites. Mixed-sex advertisements featuring multiple races in regular issues occurred at about the same rate in 1995 through 1997 as in 2004 through 2006; however, in special issues these advertisements were more common in 2004 through 2006.

Table 4: Race Distribution in Male-Only, Female-Only, and Mixed-Sex Advertisements in *Science*, 1995-1997

		White	African American	Asian American	Multiple Races
Regular Issues	Male-Only (n=528)	87.1%	5.1%	6.8%	0.9%
	Female-Only (n=247)	80.9%	9.3%	8.9%	0.8%
	Mixed-Sex (n=57)	24.6%	1.7%	0.0%	73.6%
Special Issues	Male-Only (n=80)	82.5%	10.0%	6.3%	0.8%
	Female-Only (n=74)	54.1%	16.2%	4.1%	25.7%
	Mixed-Sex (n=108)	39.8%	0.9%	0.0%	59.3%

Source: Barbercheck 2001, p. 121

Sex and Race in Individuals

Overall 4,410 individuals appeared in the advertisements. Males and females were shown in about equal numbers, although males outnumbered females in AAAS advertisements (see Table 5). The almost equal depiction of individual males and females despite the greater frequency of male-only advertisements arises from the larger number of females compared to males shown in mixed-sex advertisements. The majority of the individuals, or 69% overall, were White. White males outnumbered White females, while African American and Asian American females generally outnumbered African American and Asian American males.

Table 5: Individuals by Sex and Race in *Science*, 2004-2006

		Total		White		African American		Asian American		Other	
		Number	%	Number	%	Number	%	Number	%	Number	%
All Issues	Total Individuals	4410	100%	3041	69%	558	12%	648	15%	163	4%
	Male	2218	50%	1662	55%	187	34%	258	40%	112	69%
	Female	2192	50%	1379	45%	371	66%	390	60%	51	31%
Regular Issues	Total Individuals	4037	100%	2791	69%	503	12%	590	15%	153	4%
	Male	2032	50%	1524	55%	169	34%	233	39%	107	70%
	Female	2005	50%	1267	45%	334	66%	357	61%	46	30%
Special Issues	Total Individuals	373	100%	250	67%	55	15%	58	15%	10	3%
	Male	186	50%	138	55%	18	33%	25	43%	5	50%
	Female	187	50%	112	45%	37	67%	33	57%	5	50%
AAAS Advertisements	Total Individuals	770	100%	587	76%	56	7%	111	15%	16	2%
	Male	475	62%	419	71%	28	50%	24	22%	4	25%
	Female	295	38%	168	29%	28	50%	87	78%	12	75%
Non-AAAS Advertisements	Total Individuals	3640	100%	2454	67%	502	14%	537	15%	147	4%
	Male	1743	48%	1243	51%	159	32%	234	44%	108	73%
	Female	1897	52%	1211	49%	343	68%	303	56%	39	27%

Advertisements with Scientists

The number of male-only, female-only, and mixed-sex advertisements that showed at least one scientist totaled 1259 overall, or 70% of the advertisements. Overall female-only advertisements depicted scientists often, at 92% of the advertisements, while male-only and mixed-sex advertisements did so in 72% and 50% of the advertisements, respectively (see Table 6). Regular and special issues depicted scientists in male-only advertisements consistently, although this was not the case for female-only and mixed-sex advertisements. AAAS advertisements depicted scientists frequently in both single-sex and mixed-sex advertisements.

Table 6: Advertisements with Scientists in *Science*, 2004-2006

	All Advertisements (n=1259, 70%)		Regular Issues (n=1110, 69%)		Special Issues (n=149, 73%)		AAAS Advertisements (n=394, 83%)		Non-AAAS Advertisements (n=865, 65%)	
Male-Only Advertisements	561	72%	497	72%	64	74%	209	81.3%	352	67%
Female-Only Advertisements	407	92%	354	94%	53	79%	96	97.0%	311	90%
Mixed-Sex Advertisements	291	50%	259	49%	32	62%	89	76.7%	202	43%

Barbercheck (2001) found that in 1995 through 1997 mixed-sex advertisements in regular issues depicted scientists most often compared to male-only and female-only advertisements (see Table 7). In special issues female-only advertisements contained relatively more scientists than regular issues. Female-only and mixed-sex advertisements depicting at least one scientist increased in 2004 through 2006 compared to 1995 through 1997.

Table 7: Advertisements with Scientists in *Science*, 1995-1997

	Regular Issues	Special Issues
Male-Only Advertisements	72.5%	66.3%
Female-Only Advertisements	63.5%	70.2%
Mixed-Sex Advertisements	78.9%	59.3%

Source: Barbercheck 2001, p. 121

Individual Scientists

Individual male and female scientists were represented in about equal numbers overall (see Table 8). However, at 61% of the individual scientists, males outnumbered females noticeably in AAAS advertisements. In total 67% of the individual scientists were White, 13% were African American, 18% were Asian American, and 2% were Other. White male scientists outnumbered White female scientists, while African American and Asian American female scientists outnumbered African American and Asian American male scientists.

Table 8: Individual Scientists by Sex and Race in *Science*, 2004-2006

		Total		White		African American		Asian American		Other	
		Number	%	Number	%	Number	%	Number	%	Number	%
All Issues	Total Individuals	2256	100%	1509	67%	285	13%	408	18%	54	2%
	Male	1135	50%	893	59%	91	32%	113	28%	38	70%
	Female	1121	50%	616	41%	194	68%	295	72%	16	30%
Regular Issues	Total Individuals	2016	100%	1351	67%	253	13%	364	18%	48	2%
	Male	1014	50%	802	59%	79	31%	97	27%	36	75%
	Female	1002	50%	549	41%	174	69%	267	73%	12	25%
Special Issues	Total Individuals	240	100%	158	66%	32	13%	44	18%	6	3%
	Male	121	50%	91	58%	12	37%	16	36%	2	33%
	Female	119	50%	67	42%	20	63%	28	64%	4	67%
AAAS Advertisements	Total Individuals	597	100%	454	76%	41	7%	95	16%	7	1%
	Male	366	61%	324	71%	16	39%	24	25%	2	29%
	Female	231	39%	130	29%	25	61%	71	75%	5	71%
Non-AAAS Advertisements	Total Individuals	1659	100%	1055	64%	244	14%	313	19%	47	3%
	Male	769	46%	569	54%	75	31%	89	28%	36	77%
	Female	890	54%	486	46%	169	69%	224	72%	11	23%

Advertisements with Scientific Heroes, Authorities, or Experts

In total male-only advertisements depicted a scientific hero, authority, or expert most often at 38% of the total male-only advertisements, compared to 34% of female-only advertisements and 22% of mixed-sex advertisements (see Table 9). AAAS advertisements showed a hero particularly often in male-only advertisements, at 55%. In general male-only advertisements depicted a hero most often, female-only advertisements second most often, and mixed-sex advertisements did so least often.

Table 9: Advertisements with Heroes, Authorities, or Experts in *Science*, 2004-2006

	All Advertisements (n=579, 32%)		Regular Issues (n=505, 31%)		Special Issues (n=74, 36%)		AAAS Advertisements (n=206, 44%)		Non-AAAS Advertisements (n=373, 28%)	
Male-Only Advertisements	299	38%	263	38%	36	42%	142	55%	157	30%
Female-Only Advertisements	150	34%	126	34%	24	36%	29	29%	121	35%
Mixed-Sex Advertisements	130	22%	116	22%	14	27%	35	30%	95	20%

Barbercheck (2001) found that in 1995 through 1997 male-only advertisements in regular issues depicted the most heroes relative to female-only and mixed-sex advertisements (see Table 10). In special issues mixed-sex advertisements portrayed proportionately the most heroes. Female-only advertisements also increased in special issues compared to regular issues, while male-only advertisements decreased depiction of heroes. Advertisements depicting a hero decreased in 2004 through 2006 compared to 1995 through 1997, particularly in mixed-sex advertisements. The proportion of single-sex and mixed sex advertisements with at least one hero was more consistent in regular and special issues in 2004 through 2006 compared to 1995 through 1997.

Table 10: Advertisements with Heroes, Authorities, or Experts in *Science*, 1995-1997

	Regular Issues	Special Issues
Male-Only Advertisements	63.2%	52.8%
Female-Only Advertisements	44.5%	55.6%
Mixed-Sex Advertisements	56.2%	68.7%

Source: Barbercheck 2001, p. 122

Individual Scientific Heroes, Authorities, or Experts

Overall, male scientific heroes, authorities, or experts outnumbered females at 61% and 39% of the individuals, respectively (see Table 11). At 76% overall, the majority of heroes were White. In total the remaining heroes were 8% African American, 13% Asian American and 3% Other. Male heroes generally outnumbered female heroes for Whites and African Americans, while Asian American female heroes generally outnumbered Asian American male heroes.

Table 11: Individual Heroes, Authorities, or Experts in *Science* by Sex and Race, 2004-2006

		Total		White		African American		Asian American		Other	
		Number	%	Number	%	Number	%	Number	%	Number	%
All Issues	Total Individuals	861	100%	665	76%	65	8%	109	13%	22	3%
	Male	527	61%	434	65%	39	60%	39	36%	15	68%
	Female	334	39%	231	35%	26	40%	70	64%	7	32%
Regular Issues	Total Individuals	755	100%	591	78%	53	7%	93	13%	18	2%
	Male	468	62%	388	66%	35	66%	32	34%	13	72%
	Female	287	38%	203	34%	18	34%	61	66%	5	28%
Special Issues	Total Individuals	106	100%	74	70%	12	11%	16	15%	4	4%
	Male	59	56%	46	62%	4	33%	7	44%	2	50%
	Female	47	44%	28	38%	8	67%	9	56%	2	50%
AAAS Advertisements	Total Individuals	265	100%	254	96%	4	2%	6	2%	1	0%
	Male	201	76%	194	76%	4	100%	3	50%	0	0%
	Female	64	24%	60	24%	0	0%	3	50%	1	100%
Non-AAAS Advertisements	Total Individuals	596	100%	411	69%	61	10%	103	17%	21	4%
	Male	326	55%	240	58%	35	57%	36	35%	15	71%
	Female	270	45%	171	42%	26	43%	67	65%	6	29%

Advertisements with “Nerds” or Nonconformists

Male-only advertisements featured “nerds” or nonconformists most often, at 13% of the male-only advertisements overall (see Table 12). Female-only advertisements and mixed-sex advertisements depicted “nerds” or nonconformists far less often, at 2% and 1%, respectively. Advertisements in regular issues were more likely to depict a “nerd” than advertisements in special issues. Male-only and mixed-sex non-AAAS advertisements were more likely to depict a “nerd” than male-only and mixed-sex AAAS advertisements.

Table 12: Advertisements with “Nerds” or Nonconformists in *Science*, 2004-2006

	All Advertisements (n=118, 7%)		Regular Issues (n=111, 7%)		Special Issues (n=7, 3%)		AAAS Advertisements (n=25, 5%)		Non-AAAS Advertisements (n=93, 7%)	
Male-Only Advertisements	105	13%	100	14%	5	6%	20	8%	85	16%
Female-Only Advertisements	9	2%	7	2%	2	3%	5	5%	4	1%
Mixed-Sex Advertisements	4	1%	4	1%	0	0%	0	0%	4	1%

Barbercheck found that in 1995 through 1997, male only advertisements most often depicted a “nerd” or nonconformist at 18.6% of the male-only advertisements (see Table 13). Female-only and mixed-sex advertisements depicted a “nerd” in 6.6% and 2.2% of the advertisements, respectively. Use of advertisements with “nerds” decreased in 2004 through 2006 compared to 1995 through 1997. However, the high level of male-only advertisements with “nerds” compared to female-only and mixed-sex advertisements remained consistent.

Table 13: Advertisements with “Nerds” or Nonconformists in *Science*, 1995-1997

	All Advertisements
Male-Only Advertisements	18.6%
Female-Only Advertisements	6.6%
Mixed-Sex Advertisements	2.2%

Source: Barbercheck 2001, p. 123

Individual “Nerds” or Nonconformists

Overall the majority of the individual “nerds” or nonconformists were male both in general and within each racial category (see Table 14). Overall 88% of the “nerds” were male. White “nerds” or nonconformists were most numerous at 91% of the individual “nerds” or nonconformists. Non-White female “nerds” were not depicted.

Table 14: Individual “Nerds” or Nonconformists by Sex and Race in *Science*, 2004-2006

		Total		White		African American		Asian American		Other	
		Number	%	Number	%	Number	%	Number	%	Number	%
All Issues	Total Individuals	129	100%	117	91%	8	5%	2	2%	2	2%
	Male	113	88%	101	86%	8	100%	2	100%	2	100%
	Female	16	12%	16	14%	0	0%	0	0%	0	0%
Regular Issues	Total Individuals	122	100%	111	91%	7	5%	2	2%	2	2%
	Male	108	89%	97	87%	7	100%	2	100%	2	100%
	Female	14	11%	14	13%	0	0%	0	0%	0	0%
Special Issues	Total Individuals	7	100%	6	86%	1	14%	0	0%	0	0%
	Male	5	71%	4	67%	1	100%	0	0%	0	0%
	Female	2	29%	2	33%	0	0%	0	0%	0	0%
AAAS Advertisements	Total Individuals	25	100%	25	100%	0	0%	0	0%	0	0%
	Male	20	80%	20	80%	0	0%	0	0%	0	0%
	Female	5	20%	5	20%	0	0%	0	0%	0	0%
Non-AAAS Advertisements	Total Individuals	104	100%	92	88%	8	8%	2	2%	2	2%
	Male	93	89%	81	88%	8	100%	2	100%	2	100%
	Female	11	11%	11	12%	0	0%	0	0%	0	0%

Advertisements with Athletes

Male-only advertisements depicted athletes most often, at 11% of the male-only advertisements in total (see Table 15). In general female-only advertisements depicted an athlete less often, at 8% overall, while at least one male and one female athlete were depicted in 1% of the mixed-sex advertisements.

Table 15: Advertisements with Athletes in *Science*, 2004-2006

Athlete	All Advertisements (n=124, 7%)		Regular Issues (n=112, 7%)		Special Issues (n=12, 6%)		AAAS Advertisements (n=16, 3%)		Non-AAAS Advertisements (n=108, 8%)	
Male-Only Advertisements	83	11%	76	11%	7	8%	12	5%	71	14%
Female-Only Advertisements	37	8%	32	9%	5	7%	0	0%	37	11%
Mixed-Sex Advertisements	4	1%	4	1%	0	0%	4	3%	0	0%

In 1995 through 1997 athletes appeared in 14.2% of male-only advertisements (see Table 16). Female-only and mixed-sex advertisements depicted athletes far less often. These trends are generally upheld in 2004 through 2006 advertisements.

Table 16: Advertisements with Athletes in *Science*, 1995-1997

	All Advertisements
Male-Only Advertisements	14.2%
Female-Only Advertisements	2.8%
Mixed-Sex Advertisements	2.2%

Source: Barbercheck, 2001, p. 124

Individual Athletes

Overall male athletes outnumbered females at 72% of the individual athletes (see Table 17). The majority of the athletes were White at 89% of the individual athletes. For all races male athletes outnumbered female athletes, except for African Americans in special issues. Asian American athletes were not shown.

Table 17: Individual Athletes by Sex and Race in *Science*, 2004-2006

		Total		White		African American		Asian American		Other	
		Number	%	Number	%	Number	%	Number	%	Number	%
All Issues	Total Individuals	148	100%	132	89%	13	9%	0	0%	3	2%
	Male	107	72%	97	73%	7	54%	0	0%	3	100%
	Female	41	28%	35	27%	6	46%	0	0%	0	0%
Regular Issues	Total Individuals	136	100%	121	89%	12	9%	0	0%	3	2%
	Male	100	74%	90	74%	7	58%	0	0%	3	100%
	Female	36	26%	31	26%	5	42%	0	0%	0	0%
Special Issues	Total Individuals	12	100%	11	92%	1	8%	0	0%	0	0%
	Male	7	58%	7	64%	0	0%	0	0%	0	0%
	Female	5	42%	4	36%	1	100%	0	0%	0	0%
AAAS Advertisements	Total Individuals	20	100%	12	60%	8	40%	0	0%	0	0%
	Male	16	80%	12	100%	4	50%	0	0%	0	0%
	Female	4	20%	0	0%	4	50%	0	0%	0	0%
Non-AAAS Advertisements	Total Individuals	128	100%	120	94%	5	4%	0	0%	3	2%
	Male	91	71%	85	71%	3	60%	0	0%	3	100%
	Female	37	29%	35	29%	2	40%	0	0%	0	0%

Advertisements with Caregivers

Female-only advertisements depicted far more caregivers relative to male-only and mixed-sex advertisements (see Table 18).

Overall 7% of female-only advertisements depicted a caregiver, compared to 1% of male-only advertisements and 2% of mixed-sex advertisements. However, in AAAS advertisements, female-only advertisements did not depict caregivers.

Table 18: Advertisements with Caregivers in *Science*, 2004-2006

	All Advertisements (n=45, 1%)		Regular Issues (n=39, 2%)		Special Issues (n=6, 3%)		AAAS Advertisements (n=8, 2%)		Non-AAAS Advertisements (n=37, 3%)	
Male-Only Advertisements	7	1%	6	1%	1	1%	4	2%	3	1%
Female-Only Advertisements	29	7%	25	7%	4	6%	0	0%	29	7%
Mixed-Sex Advertisements	9	2%	8	2%	1	2%	4	3%	5	1%

Individual Caregivers

At 78% of the individual caregivers, females greatly outnumbered males (see Table 19). Caregivers were predominantly White, at 88% of the individuals overall, although African American caregivers were also present. Asian American and Other race caregivers were not depicted. For Whites and African Americans, female caregivers generally outnumbered male caregivers, although this was not the case in AAAS advertisements.

Table 19: Individual Caregivers in *Science*, 2004-2006

		Total		White		African American		Asian American		Other	
		Number	%	Number	%	Number	%	Number	%	Number	%
All Issues	Total Individuals	40	100%	35	88%	5	12%	0	0%	0	0%
	Male	9	22%	8	23%	1	20%	0	0%	0	0%
	Female	31	78%	27	77%	4	80%	0	0%	0	0%
Regular Issues	Total Individuals	35	100%	31	89%	4	11%	0	0%	0	0%
	Male	8	23%	7	23%	1	25%	0	0%	0	0%
	Female	27	77%	24	77%	3	75%	0	0%	0	0%
Special Issues	Total Individuals	5	100%	4	80%	1	20%	0	0%	0	0%
	Male	1	20%	1	25%	0	0%	0	0%	0	0%
	Female	4	80%	3	75%	1	100%	0	0%	0	0%
AAAS Advertisements	Total Individuals	4	100%	4	100%	0	0%	0	0%	0	0%
	Male	4	100%	4	100%	0	0%	0	0%	0	0%
	Female	0	0%	0	0%	0	0%	0	0%	0	0%
Non-AAAS Advertisements	Total Individuals	36	100%	31	86%	5	14%	0	0%	0	0%
	Male	5	14%	4	13%	1	20%	0	0%	0	0%
	Female	31	86%	27	87%	4	80%	0	0%	0	0%

Easy/Simple

Female-only advertisements were most closely associated with the use of the words *easy* or *simple* (see Table 20). Overall 10% of the female-only advertisements used these words, compared to 4% of male-only advertisements and 2% mixed-sex advertisements. Special issues used these words less than regular issues in single-sex advertisements but more in mixed-sex advertisements.

Table 20: *Easy/Simple* in Advertisements in *Science*, 2004-2006

	All Advertisements (n=81, 4%)		Regular Issues (n=73, 5%)		Special Issues (n=8, 4%)		AAAS Advertisements (n=8, 2%)		Non-AAAS Advertisements (n=73, 5%)	
Male-Only Advertisements	29	4%	27	4%	2	2%	0	0%	29	6%
Female-Only Advertisements	43	10%	39	10%	4	6%	8	8%	35	10%
Mixed-Sex Advertisements	9	2%	7	1%	2	4%	0	0%	9	2%

Barbercheck (2001) found that in 1995 through 1997 female-only advertisements were associated with the words *easy* or *simple* in regular issues, while the same was true for male-only advertisements in special issues (see Table 21). Compared to 1995 through 1997, advertisements in 2004 through 2006 had a more consistent association between these words and female-only advertisements.

Table 21: *Easy/Simple* in Advertisements in *Science*, 1995-1997

	Regular Issues	Special Issues
Male-Only Advertisements	6.7%	10.8%
Female-Only Advertisements	13.3%	4.8%
Mixed-Sex Advertisements	2.7%	1.7%

Source: Barbercheck 2001, p. 126

Efficient/Fast/Reliable/Accurate

The words *efficient*, *fast*, *reliable*, or *accurate* were associated closely with both male-only advertisements and female-only advertisements (see Table 22). In total 4% of male-only advertisements featured these words, while 4% of female advertisements and 3% of mixed-sex advertisements did so. Female-only advertisements used these words most-often in special issues. AAAS advertisements did not use these words.

Table 22: *Efficient/Fast/Reliable/Accurate* in Advertisements in *Science*, 2004-2006

	All Advertisements (n=66, 4%)		Regular Issues (n=56, 3%)		Special Issues (n=10, 5%)		AAAS Advertisements (n=0, 0%)		Non-AAAS Advertisements (n=66, 5%)	
Male-Only Advertisements	30	4%	27	4%	3	3%	0	0%	30	6%
Female-Only Advertisements	19	4%	15	4%	4	6%	0	0%	19	6%
Mixed-Sex Advertisements	17	3%	14	3%	3	6%	0	0%	17	4%

Barbercheck (2001) found that in 1995 through 1997 male-only advertisements were closely associated with the words *reliable*, *fast* and *accurate* (see Table 23). The word *efficient* was also likely included in this analysis. Mixed-sex advertisements in regular issues also used these words extensively. These words were used less often in 2004 through 2006 than in 1995 through 1997. These words were more closely affiliated with male-only advertisements in 1995 through 1997 than in 2004-2006.

Table 23: *Reliable/Fast* and *Efficient/Accurate* in Advertisements in *Science*, 1995-1997

	Regular Issues	Special Issues
Male-Only Advertisements	19.7%	22.9%
Female-Only Advertisements	10.9%	4.8%
Mixed-Sex Advertisements	12.8%	1.7%

Source: Barbercheck 2001, p. 126

DISCUSSION

This chapter discusses the significance of the results of this study using the previously presented theories and concepts as a means of analysis. First, each category as described in the analysis is discussed in terms of qualitative character and quantitative significance. The qualitative discussion serves to establish the impact of the specific category. The quantitative data provides insight to the degree to which the advertisements reflect reality, and is analyzed in terms of Barbercheck's study of contemporary scientists. Second, a qualitative analysis of themes relevant to race and gender is presented. This section illustrates usage of stereotypes in the advertisements that are analytically significant but are not captured in the quantitative data.

Gender and Race in Advertisements

The sex distribution statistics as presented in the results chapter provide insight to gender roles, norms, and stereotypes. The proportions of single-sex and mixed-sex advertisements express norms and beliefs about men and women. Likewise, the racial distribution statistics indicate apparent norms, roles, and stereotypes for different races. The intersection of race and sex in the distribution statistics provides further insight into the use of stereotypes for scientists and non-scientists alike.

A postmodern feminist perspective on the way gender and race are portrayed in the advertisements centers on the perspective from which the advertisements are created and viewed. An alternative viewpoint most effectively allows a critical analysis of the social messages portrayed in the advertisements. Special attention to

easily overlooked messages about privilege and inequalities provides insight to the significance of all stereotypes depicted.

The prevalence of male-only advertisements in all issue and advertisement types in 1995 through 1997 and 2004 through 2006 indicates that masculine imagery is still highly valued. The preference for mixed-sex advertisements over female-only advertisements demonstrates restriction of purely feminine imagery.

In 1995 through 1997 the use of mixed-sex advertisements increased dramatically in special issues compared to regular issues. This trend indicates that advertisers at that time were especially sensitive to messages about gender sent in special issues. Depiction of men and women together was an acceptable way to portray increased gender equality. This tendency was less apparent in 2004 through 2006, as the proportion of single-sex and mixed-sex advertisements did not change as radically in regular versus special issues. The decline in the significance of the social messages in special issues was counteracted by the overall increase in diverse gender imagery. This trend suggests a more consistent consideration of the proportion of male to female advertisements.

Compared to 1995 through 1997, the advertisements in 2004 through 2006 used less purely masculine imagery in regular issues and overall. Although male-only advertisements in regular issues increased in special issues, the relative increase of mixed-sex advertisements suggests a continued desire to depict gender equality.

However, the manner in which gender equality is represented is restricted according to social norms. It is more acceptable for the portrayal of gender equality to

take the form of men and women shown together rather than the more radical image of women without men. Although sensitivity to gender equality is displayed in the advertisements, preference for the masculine over the feminine is maintained, in accordance with patriarchal norms. Androcentricity is displayed in the advertisements despite the façade of increased gender equality. This value is particularly evident in AAAS advertisements, as purely masculine imagery is much more utilized than purely feminine imagery.

The depiction of race within single-sex and mixed-sex advertisements again displays a tendency to depict increased diversity but only in a manner that supports the status quo. The majority of advertisements are male-only advertisements depicting Whites, female-only advertisements depicting Whites, and mixed-sex advertisements depicting more than one race. Male-only advertisements are almost devoid of racial diversity. AAAS advertisements in particular used a large portion of White, male-only advertisements. Whites also dominate female-only advertisements but portray relatively more racial diversity. In 1995 through 1997 Barbercheck also found that single-sex advertisements featuring only Whites and mixed-sex advertisements with more than one race were most common.

It is most acceptable to portray diversity in groups of more than one race with both men and women rather than in single-sex advertisements with non-Whites. Whiteness maintains its stereotypical normalcy as it occurs most frequently in single-sex advertisements. The dominance of Whites and of males is not endangered as Whites and males are present in most mixed-sex and multiple race advertisements.

White males are a tempering presence to counteract racial diversity and gender equality. This trend has not shifted significantly over time, indicating that the foundations of the stereotypical representations of figures within the advertisements have not been notably changed.

Gender and Race in Individuals

According to Evans, Price, and Barron (2001) of the U.S. Census Bureau, in 2000, the most recent year for which official information is available, individuals self-identifying as White made up about 75.1% of the total population. The figure was 12.3% for African Americans and 3.6% for Asian Americans. The remaining 9.0% of the population self-identified as some other race, including American Indian or Native Alaskan, Native Hawaiian or Pacific Islander, as well as mixed-race. Additionally, 12.5% of the total population of any race self-identifies as ethnically Hispanic or Latino.

The distribution of the individuals by race in the advertisements leaned heavily but not exclusively on whites. Whites in regular issues, special issues, and non-AAAS advertisements were slightly underrepresented compared to the general population. AAAS advertisements depict Whites in proportion with the actual population. African Americans were about proportionately depicted in regular issues, special issues, and non-AAAS advertisements, although they were significantly underrepresented in AAAS advertisements. Asian Americans were clearly overrepresented in all issue and advertisement types. Individuals of Other descent were underrepresented in all issue and advertisement types.

In general White males outnumbered White females, while non-White females outnumbered non-White males. AAAS advertisements notably depicted far more White males than females and more Asian American females than Asian American males. Although Whites are not overrepresented, the racial proportions of the individuals to some extent reflect the general interests of White males. As non-White males are generally underrepresented, White males possess the greatest amount of social power. Non-White women are used to portray racial diversity. The relative lack of a proportionate non-White male presence also suggests sexual availability. The lack of proportionate representation of non-White men and women undermines the suggested racial diversity.

Scientists

In the advertisements two main archetypes for scientists emerged: the anonymous scientist and the noble scientist. Anonymous scientists were typically shown engaged in routine scientific work. The focus of these advertisements was often the improved work process offered by a specific technology being promoted. The identity or even quality of the scientist was of lesser importance compared to the means by which research was conducted. On the other hand, advertisements featuring a noble scientist elevated science as an intellectual pursuit. These scientists, who may or may not have been depicted as heroes, authorities, or experts, were shown in a manner that indicated that they were part of a celebrated and highly significant scholarly activity.

Predictably, scientists were often represented in the advertisements. Female-only advertisements were rarely without the presence of a scientist. In contrast male-only advertisements did not elect to depict a scientist as often. There was a significant shift in advertisements depicting scientists in 2004 through 2006 compared to 1995 through 1997. There was a dramatic increase in the proportion of female-only advertisements depicting scientists. Male-only advertisements with scientists were comparably stable, while mixed-sex advertisements with scientists were generally less prevalent. The depiction of women as scientists increased, while the depiction of men and women as scientists together decreased.

Advertisers apparently choose to construct a stronger association between women and science in the advertisements that appeared in 2004 through 2006. In a sense this trend indicates that the feminine is valued more in science than it was in the past. On the other hand, this shift references a certain anxiety about the participation of women in science. While male-only advertisements in a certain sense depict a more varied and multifaceted image of masculinity, female-only advertisements remain focused on scientific occupation. These advertisements seem to actively create an image of women in science as natural, while in male-only advertisements it is taken for granted that men fully participate in science.

Although the distribution of scientists in single-sex and multiple-sex advertisements is unequal, this is not the case for depiction of individual male and female scientists. Overall male and female scientists are depicted in about equal numbers. This equal representation is the case for regular issues and special issues.

However, in AAAS advertisements male scientists outnumber female scientists 6 to 4, while in non-AAAS advertisements male scientists slightly outnumber female scientists.

In 2003, the most recent year for which official information is available, approximately 869,600 individuals with at least a bachelor's degree were employed as biological, life, or physical scientists, including medical doctors and secondary educators (National Science Foundation, 2006b). Of this group, 62% were male and 38% were female. This information indicates that although it would at first appear that AAAS advertisements do not depict male and female scientists in equal number, the 60/40 split is more representative of the actual scientific population in the U.S. Non-AAAS advertisements depict an ideal 50/50 split; in doing so they reject the male scientist stereotype. Of the individual scientists, about 64% to 67% were White in regular issues, special issues, and non-AAAS advertisements. However, in AAAS advertisements this figure was 76%. African American scientists were represented as about 13% of the total scientists in regular issues, special issues, and non-AAAS advertisements, although in AAAS advertisements this figure was 7%. Asian American scientists were depicted at about 18% of the total scientists in regular issues, special issues, and non-AAAS advertisements. In AAAS advertisements this figure was 16%. Other race scientists made up about 2% of the total scientists overall.

The racial distribution of employed biological, life, or physical scientists with at least a bachelor's degree is 77.2% White, 13.5% Asian American, 3.4% African

American, 4.1% Hispanic or Latino, 0.6% American Indian/Native Alaskan, and 1.2% other race (National Science National Science Foundation, 2006a). According to these statistics, White scientists are underrepresented in all issue and advertisement types except for AAAS. African American scientists were also overrepresented. Asian American scientists were slightly overrepresented. Other race scientists were overrepresented in all issue and advertisement types except for AAAS.

It was generally more acceptable for advertisers to depict far more non-White female scientists than non-White male scientists of the same race. On the other hand, White males scientists outnumbered White female scientists consistently. This information suggests that larger numbers of non-White males may be considered an unacceptable and perhaps threatening presence. Female Asian American scientists outnumbered their male counterparts about 7 to 3. Other race females also did so in special issues and AAAS advertisements, although not in regular issues or non-AAAS advertisements. The social significance of gender and race are clearly in operation in the advertisements as there are distinct patterns of representing men and women of different races.

Technology was a key component to many advertisements featuring scientists, as many advertisements depicted scientists with various types of scientific equipment. Advertisements indicated that these technologies provide accurate and therefore impartial information. Haraway's (1988) notion of the impartial and all-seeing "god-trick" which falsely seems to provide complete objectivity through technology is

certainly in evidence in these advertisements, as the information is apparently absent of perspective.

The mediated visions provided by scientific technologies that were shown supported the notion of disembodied science, even in the face of the notable gender disparities of the scientists shown with the equipment. The relative lack of non-White male scientists in the advertisements is problematic because it downplays their scientific contributions. Portraying non-White females is still the most acceptable way of depicting racial diversity, as was the case in 1995 through 1997 (Barbercheck, 2001). Embodiment is therefore a primary factor in the way gender and race is depicted in the advertisements—even the advertisements featuring the central principle of science, objectivity.

The Hero, Authority, or Expert

Prestige is a common theme in scientific advertisements. The high status of science and scientists in our society is reinforced through use of positive imagery in advertisements. In these advertisements the portrayal of the scientist as hero is held up for the scientist to observe and reflect upon. The practice of science in these advertisements is clearly represented as a noble act very much worthy of admiration. In one advertisement, scientific innovation is directly equated with supernatural power. The act of performing science is shown as parallel to the divine act of creation as God himself is shown amidst the newly born swirling cosmos. Postmodern feminists would note that in this advertisement the masculine, powerful Judeo-Christian God and all his associated power over nature is clearly portrayed.

Another advertisement plainly conveys the inherent power of science while implicitly revealing the traditional formula for the hero scientist. This advertisement by AAAS shows a White male in a lab coat holding a globe aloft in one open hand. The camera angle is such that his head is completely obscured by the globe. The imagery in this advertisement simultaneously conjures up connotations of possessing a whole world of knowledge, as the scientist's head is symbolically replaced by the earth, and holding power over the world literally in the palm of one's hand. The text of this advertisement further underscores the theme of great authority and prestigious influence as it promotes the opportunity to present research to "world-renowned scientists and researchers" by proposing a symposium for an AAAS meeting. The direct association of White masculine scientists with expert knowledge and power in science is highlighted in this advertisement.

The scientist-as-hero theme was sometimes depicted in a quite literal sense. In several advertisements scientists transcended mere hero status and entered the realm of the superhero. Embodiment in these advertisements was especially elevated, as physical characteristics endowed the superheroes with actual magical powers. White male individuals exclusively dominated this category. For example, an advertisement depicted a White male scientist superhero much like Superman rescuing a White female scientist in a laboratory. The (male) superhero role was not restricted to adults, as in another advertisement a small White male child was dressed proudly as a superhero. The advertisements featuring a superhero scientist clearly draw upon

cultural standards that are andocentric and racially biased to reflect the values of dominant social groups.

Advertisements depicting a hero drew upon notions of mastery of nature as well as the centrality of apparently neutral scientific knowledge. Scientific knowledge and achievement in these advertisements were depicted as sometimes laborious but never arising from a specific social perspective.

The scientific hero, authority, or expert stereotype was widely used in the advertisements, especially AAAS advertisements. The hero thus functioned as a well-known and easily recognizable stereotype. Its prominence in the advertisements suggests that it is certainly an acceptable stereotype to depict, as the process of science and an individual (real or imaginary) scientist are celebrated. The use of the hero stereotype in the advertisements was common, but it was not evenly distributed among single-sex and mixed-sex advertisements. Male-only advertisements generally featured a hero most often, although non-AAAS advertisements featured proportionately more female-only advertisements with heroes. The difference in heroes in male-only and female-only advertisements was most significant in AAAS advertisements.

Compared to 1995 through 1997, advertisements in 2004 through 2006 generally depicted fewer scientific heroes. Heroes in mixed-sex advertisements decreased dramatically, while heroes in single-sex advertisements also decreased.

The hero stereotype remains distinctly allied with masculinity, but is by no means exclusive to men. Women were seriously shown as scientific heroes even in

the presence of a male hero. The shift away from depicting men and women as heroes together in favor of single-sex advertisements indicates that it is comparatively more acceptable to depict women as scientific heroes without the presence of a man. Although AAAS advertisements portrayed relatively fewer heroes in female-only advertisements, they depicted relatively more male and female heroes together. This trend indicates a strong inclination to depict both men and women as accomplished scientific achievers together.

Individual scientific heroes were typically men, especially in AAAS advertisements. Whites dominated the individual heroes, particularly White males. This trend was especially true for AAAS advertisements. Scientific heroes in the advertisements were most commonly White males, particularly in AAAS advertisements. Although White males were not overrepresented in terms of the scientific population, the stereotypical image of the hero was overwhelmingly aligned with masculinity and Whites. African Americans were proportionately represented as heroes in terms of the real scientific population, but proportionately underrepresented compared to the number of scientists that appeared. Racism is evident as the White hero stereotype is perpetuated through the lack of positive depiction of African American heroes. Aside from AAAS advertisements, Asian Americans were fairly represented as heroes both in terms of real scientist population and in proportion to the Asian American scientists depicted in the advertisements. However, gender exerted a powerful influence on the depiction of Asian American heroes, as again Asian American males were underrepresented.

The “Nerd” or Nonconformist

“Nerds” and nonconformists are similar but distinct types of individuals within the advertisements. Whereas a typical “nerd” was shown as unaware of social dress and behavior convention, a typical nonconformist was shown as actively rebelling against the social norm. One advertisement in particular highlighted the difference between these two similar groups. This advertisement featured two White males seated side by side. One was a “nerd” and the other a nonconformist. Both of these individuals were conducting research, but the nonconformist chose to use modern computer technology while the “nerd” chose to use printed reports and data. The advertisement implied that although both “nerds” and nonconformists practice science, nonconformists might do so more efficiently through their awareness of current social convention.

Another advertisement featuring a White male “nerd” illustrated the difference between “nerd” scientists and non-“nerd” scientists. This advertisement featured two individuals standing next to each other holding different pieces of equipment: a middle-aged White male “nerd” in glasses with pens neatly aligned in his lab coat pocket and a young Asian female non-“nerd” smiling brightly at the camera. Both scientists are shown as involved in important research, but they are depicted as intrinsically different types of people. Both gender and race are depicted as essential components of stereotypical “nerd” status. The masculine White “nerd” starkly contrasts with the feminine non-White normal person.

The stereotypical “nerd” or social nonconformist was a relatively rare sight in the advertisements, but was nonetheless a significant narrative element. Male-only advertisements depicted a “nerd” much more often than female-only or mixed-sex advertisements. Advertisements featuring “nerds” were most common in regular issues and non-AAAS advertisements.

Portrayal of a stereotypical “nerd” or nonconformist has decreased over Time. However, the foundation of the “nerd” stereotype remains masculine. The depiction of a “nerd” in female-only advertisements decreased, indicating further reluctance to align “nerds” and nonconformists with femininity.

The individual “nerds” that were shown also exhibited notable social characteristics. Both gender and race were guiding factors for the depiction of individual “nerds”. “Nerds” are distinctly associated with White males. The close association between the “nerd” stereotype and the practice of science powerfully implies that a deep involvement in science is impacted to some extent by social factors. The White male “nerd” stereotype may not be innocuous as it implies that an overwhelming commitment to and involvement in science is only available to select members of society. On the other hand, the portrayal of non-White males and females as “nerds” would potentially be interpreted as overwhelmingly negative. Advertisers therefore likely utilize White males in these advertisements because this dominant group is comparably less affected by negative imagery and stereotypes in the advertisements.

As he is most typically a White male, the social location of the White “nerd” or nonconformist lends him a significant amount of social power. His perspective, though separated from the mainstream, is elevated by his mastery of scientific knowledge and supported by his race and gender privileges. These elements lend him authority over knowledge production and afford him the right to assert objectivity. His embodiment is at once central and invisible. His inability to conform to or cope with social norms is signaled by his appearance, yet it is the embodied characteristics of his race and gender that silently support claims to objectivity.

Athletes

Athletic activity in the advertisements openly adhered to common gender norms. Males were depicted as engaged in more active and competitive sports whereas females were shown as engaged in more artistic and health-oriented sports. Males were also featured as sports referees or officials in several advertisements. Although these individuals were not categorized as athletes, they were clearly depicted as closely involved in athletic activities. No individuals other than the referees/officials were depicted in these advertisements. In one advertisement a White male in a black hat and black and white striped uniform is shown yelling out a sports call. The accompanying text indicates that the authority of the sports referee is similar to the certainty provided by the equipment that is being advertised, as it provides, “The image performance you can count on to make an accurate call.” The male as a figure of authority in sports was maintained in these advertisements, as is consistent with the reality of athletic officiating.

Another advertisement featuring sports officials depicts a carefully crafted group of athletic judges. Although the sport they are judging is not clear, the race and sex distribution of the individuals reveal a far more important message. Seated at the judges' table facing the camera are two White males, one White female, one African American female, one Asian American female, and one male apparently of Other racial descent holding up score cards. All individuals are wearing lab coats, indicating that they are scientists, and are all young adults save one older White male. In a similar advertisement placed by a different company, four individuals dressed professionally are again seated a judges' table. There are two White male judges, one White female judge and one Asian American male judge. The individuals are middle-aged or older. In both advertisements the featured product has achieved a score of a perfect 10.

The advertisements featuring athletic judges balance the race and sex of the individuals shown. In both groups Whites outnumber other races and White males are shown more frequently than other race and sex combinations. Males and females of races other than White are included in a manner that indicates ethnic diversity but does not upset the status quo.

Male athletes were more often shown engaged in more strenuous sports and physical activities than women. Males were shown taking part in activities such as rock climbing, snowboarding, boxing, and football, whereas women were shown doing sports such as acrobatics, speed walking, and diving. However, one recurring

advertisement featured a White female racecar driver who was shown holding a helmet while standing next to an extremely futuristic car.

The same company using the same model for two different advertisements placed the majority of the advertisements featuring a woman athlete. These advertisements used photo editing to alter the image so that the activities the model was pictured performing were actually physically impossible. In these advertisements a young White woman was shown performing a complete backbend along a vertical wall or climbing up a bare wall without any visible means of support. Although these advertisements depicted a woman participating in strenuous physical activity, the character of the activity differed from advertisements depicting men engaged in sports or athletics. The emphasis here was not on competition but rather simple ability. The lack of the law of gravity further emphasized that this advertisement did not depict women in sports as an important theme in the advertisements.

Advertisements featuring sports and athletics often drew upon themes such as competition, speed, and toughness in the visual message or the advertising text. These traditionally masculine qualities were often used to illustrate the effectiveness of a certain technology or product. Competition within science was depicted as a ruthless but inescapable struggle. In order to survive and to thrive, scientists had to utilize the newest and best technology and methods available. The extensive use of masculine ideals of physical competition as a metaphor for scientific research recalls feminist theory, which notes that in a sense science seeks to dominate nature. Nature and

culture are divided and ranked according to masculine ideals. Masculine athletic imagery parallels patriarchal subordination of nature along with femininity.

Male-only advertisements were most likely to depict at least one athlete. Female-only advertisements did so about half as often. Mixed-sex advertisements rarely depicted both a male and female athlete, although all of the AAAS advertisements with an athlete did so.

There was a decrease in advertisements portraying an athlete in both single-sex and mixed-sex advertisements. As is consistent with the 1995 through 1997 information, male-only advertisements in 2004 through 2006 utilized the majority of athlete imagery. There was a consistent and clear association between participation in competitive sports or exercise and masculinity. The direct connection between physical competition and masculinity is emphasized by the relative lack of women in advertisements with athletes. Athletics in this context are clearly dominated by men and masculinity. Moreover, there is very little evidence of men and women participating in sports together. This fact indicates a persistent separation of the genders in matters of physical fitness. The advertisements suggest that participation in sports and athletics is limited very strongly by gender. The lack of equal representation of men and women as athletes recalls exclusionary practices. This exclusion is a direct result of the stereotypically gendered portrayal of competition.

The characteristics of the individuals pictured as athletes likewise indicate that participation in sports is impacted by social factors. The individual athletes are overwhelmingly White or African American. Asian American athletes are entirely

absent. Stereotypical portrayal of athletes in the advertisements is closely aligned with White males. Gender and race plainly impact the athlete stereotype. The primary connotations of the athlete stereotype are the importance of dominance and competition. Within the context of the advertisements, White males and sports competition recall the patriarchal structure of society, as well as the continued relevance of ranks and hierarchies that undermine diversity and equality. Masculinity is certainly a primary element in all of these concepts. African American masculinity in these advertisements is very stereotypically associated with athleticism. In depicting athletics as primarily the domain of White men, the advertisements suggest that this group also possesses the ability to effectively compete and achieve in wider society.

Caregivers

Caregivers were predictably most often associated with parenting activities, although a significant number of advertisements showed children receiving treatment from medical professionals. Caregivers in the advertisements represented responsibility for the intellectual and physical health of future generations. Gender was a notable factor in advertisements depicting caregivers. The traditionally nurturing and loving characteristics of ideal mothers were often depicted. Even female medical professionals treating children were portrayed as patient and responsible.

Willing and affectionate involvement with children characterized advertisements featuring caregivers. For example, one reoccurring advertisement depicts a mother holding her toddler son. She dances with him while rejoicing that he

has regained his health due to scientific achievements and progress. Science has provides her with happiness. Her emotions are depicted in a traditionally feminine manner because her fulfillment is derived from her child.

The race and sex characteristics of the caregivers reveal significant usage of social stereotypes. Caregivers occurred most frequently in female-only advertisements. This information indicates that childcare, either in a parental or medical sense, is typically a female occupation. Maternal activity is a crucial element of femininity in the advertisements.

The depiction of the feminine nature of childcare is further evidenced by the characteristics of the individual caregivers. In general the advertisements reflect and uphold the gendered character of childcare. Women are portrayed as primary caregivers. However, AAAS advertisements seem to challenge the notion of childcare as dominated by women by preferring to depict only male caregivers. By completely reversing the stereotypical gender of a caregiver, these advertisements draw attention to their progressive vision of childcare. White individuals, specifically White women, dominated the caregiver category, although African American caregivers were also shown. The association of women with motherhood was much stronger than the association of men with fatherhood.

Special Qualities

Patterns of the ways in which the words *easy*, *simple*, *efficient*, *fast*, *reliable*, and *accurate* are used indicate that these words are linked to the racial and gender characteristics of the individuals appearing in the advertisements. The advertisements

used language in a distinctly gendered manner in advertising text, as word choice and the sex of the individual featured in an advertisement were often linked. In this way notions of gender were associated with certain words. Word choice in this context indicated the relative social power and scientific prowess of the individuals pictured as a function of their sex and race.

Easy/Simple

The use of the words *easy* or *simple* in the advertisements had both positive and negative connotations. On the one hand, advertisements featuring these words sometimes indicate that a routine task that is simplified through the use of scientific technology can allow a scientist to focus on more important goals. In this way important research can be conducted rather than unimportant tasks. On the other hand, other advertisements featuring these words also depicted low-level and rote scientific work that is not associated with great scientific achievement. For example, an advertisement series clearly depicted using a machine as so simple that a baby can do it. In these advertisements an African American male baby was shown playing with lettered wooden blocks while separate pictures displayed a single scientist working in a laboratory. The text of the advertisement proudly declares that using the machine is, "... as easy as A, B, C!" This advertisement series clearly depicts routine scientific work and non-hero scientists. Both male and female scientists were featured in this advertisement series; however, the advertisements featuring the female outnumbered the advertisements featuring the male scientist.

Female-only advertisements were clearly more associated with the words *easy* or *simple* than male-only or mixed-sex advertisements. Female-only advertisements were at least twice as likely to feature these words as male-only advertisements across issue and advertisement type.

This pattern has persisted over time, as the association between the words *easy* or *simple* and women has become more consistent across issue and advertisement type. Gender is a determining factor in the usage of the words *easy* or *simple*. The connotations of these words reflect both social power and standing. In light of women's overall lower social status compared in general to men, these words suggest lower intellectual ability. The association of the words with women undermines their status within science and in wider society.

Efficient/Fast/Reliable/Accurate

The qualities *efficient*, *fast*, *reliable*, and *accurate* were depicted as very positive traits in science. These words were often associated with the process of scientific research, if not in a specific instance of technology usage, then at least in a general sense. However, promotion of scientific technology often characterized advertisements featuring these words.

The individuals in these advertisements are connected to the traits efficient, fast, reliable or accurate. As such, gender and race are important components of these traits. Although both scientists and non-scientists were pictured in the advertisements using these words, the practice of science remained a central theme. For example, an advertisement that claims that the featured product offers "the highest efficiency" and

is “three times more competent than the competition” depicts one White boy playing tug-of-war against a team of one Asian American and two White girls. This advertisement, which also seems to function as a metaphor for individual scientific achievement, typically suggests that White males are more effective and efficient in science.

The use of the words *efficient*, *fast*, *reliable*, or *accurate* was proportionately equal in male-only and female-only advertisements. Mixed-sex advertisements used these words at a slightly lower rate. This trend indicates a reduction of the association with those traits almost exclusively with masculinity.

Usage of the words *efficient*, *fast*, *reliable* and *accurate* has declined over time. In 1995 through 1997 male-only advertisements used these words most often (Barbercheck, 2001). In both regular and special issues in 2004 through 2006 these words were closely associated with men. Masculinity was aligned more with the characteristics *efficient*, *fast*, *reliable* and *accurate* than femininity in both regular and special issues. The almost complete lack of female-only advertisements using these words demonstrates that advertisers express notions of gender through word choice. A man had to be present in order for these words to be used in almost every case. The characteristics *efficient*, *fast*, *reliable* and *accurate* were depicted as positive and desirable qualities in scientific practice and technology. In contrast to 2004 through 2006, the advertisements in 1995 through 1997 indicated that these positive traits were presented as possessed almost exclusively by men, or perhaps only available to women in the guiding presence of a man.

Qualitative Data

Several key themes emerged which provide insight into the manner in which even scientific advertisements portray gender and racial stereotypes. Select advertisements that depict relevant social norms and beliefs were examined.

Sex and Romance

Throughout the advertisements romantic relationships between men and women were represented as normal and expected. As all romantic relationships were depicted as naturally occurring only between a man and a woman, heteronormativity reigned in all advertisements. The existence of homosexuality was absent in all advertisements. This expected trend most likely reflects the desire of advertisers to present uncontroversial and familiar themes to the readers of *Science*.

Romance and courtship between men and women was depicted in several advertisements. For example, one reoccurring advertisement depicted a young man and woman seated across from each other at a small table with a lamp on it. The two were shown gazing into each other's eyes while holding hands. The romantic nature of their contact and interaction is unmistakable. The advertisement further conveys the increasingly amorous mood by asserting, "Lower the lights." In this advertisement heterosexual romance as natural is clearly represented. Heteronormativity is presented and reinforced through the imagery and text.

Several advertisements went beyond depicting male and female romantic relationships into the territory of depicting sexual relationships. Often, these advertisements linked heterosexual sex with scientific practice by depicting intimate

moments between males and females and coyly associating those moments with the functioning of scientific equipment in the advertising text. Science and sex act as commodities in these advertisements.

One reoccurring advertisement in particular portrayed an African-American female playfully removing a White man's sweater while smiling. The man's stomach and chest are fully exposed. The woman remains fully clothed, although the short t-shirt she is wearing exposes part of her stomach. The large text of the advertisement leaves no question of the sexual nature of the interaction of the man and woman, as it reads, "When you take it off, things get interesting." Although his sweater covers the man's face, both individuals appear to be young and slim and the woman's face is attractive. As the advertisers choose to actively associate sex with the functioning of the scientific equipment that they are selling, sex functions both as a familiar, attention-getting advertising theme and as a commodity to be voyeuristically consumed by the reader. The inter-racial couple is utilized as a symbol for a specific scientific activity. In this way science and the product are portrayed as sexy and exciting.

In a similar advertisement, intimate sexual encounters between males and females are further transformed into items for scientific consumption. In this advertisement a White male is smiling ecstatically while two White women and one Asian-American woman lean on him and grasp his chest while smiling blissfully and gazing adoringly at their object of affection. His face is covered in lipstick from their kisses. It is clear in this advertisement that there is nowhere else in the world that

these individuals would rather be and no one else they would rather spend time with. All individuals pictured in this advertisement appear to be in their twenties. The main text of the advertisement declares, “Sensitivity always wins out” and goes on to explain how the product can “Achieve reliable... results from precious, diverse samples.” The attractive and somewhat racially diverse women pictured in this advertisement are depicted as samples from which the strong but sensitive man can be sure to achieve reliable results. From the obvious evidence of their close contact and intimacy, it is clear that the desired results that the man can expect are quite sexual in nature. Furthermore the product can provide “improved yields,” which parallels the orgy-like undertone of the individuals pictured. Although homosexual relationships were absent, this advertisement indicates that it is acceptable for males to have multiple female sexual partners.

Appearance

The manner in which advertisements compose the individual visual elements powerfully influences the advertisement’s implicit social messages. The way that a human figure in an advertisement is posed or photographed conveys various messages to the reader. Body language and camera angles provide the reader with a carefully crafted perspective on the individual shown in the photograph and the social value of that person or the activity. The appearance of the individuals featured in the advertisements and their corresponding attractiveness is in part a function of the way in which they are visually composed. The voyeuristic male gaze was evident in several advertisements in *Science*. For example, one advertisement featured a skirted

woman in profile, leaning over to examine the contents of a clothes dryer. She is faceless and anonymous, as her neck and head are fully inside of the dryer, though her slim, bent-over body and bare legs are on full display for the viewer; the contours of her body are the main focus of the advertisement visually. Another advertisement features a partially clothed woman who is struggling to put on a tight pair of jeans; a similar advertisement featuring a male would be almost unthinkable.

Although personal appearance is obviously very important for all individuals appearing in advertisements, the appearance of women was more likely to be explicitly the subject of the advertisements. Women's faces and bodies were more likely to be used as the focus of an advertisement. For example, an advertisement promoting investment in an Italian biotechnology company displays the female general manager of the company smiling confidently at the camera with her arms crossed in front of her next to a large caption that asks the reader, "Why is she so attractive?" The text of the advertisement goes on to explain why investing in the life sciences industry in Italy is beneficial and concludes with the text, "Attracted? We bet you are." A second advertisement in this series features the male regional vice-president of the company. As he gazes smoothly at the camera while holding his glasses in his hand, the accompanying caption reads, "Why is he so attracted?" In this advertisement series the woman is clearly transformed into an object to be consumed by the reader while the man is constructed as an individual that the reader can identify with. Additionally it is very likely that the creators of these advertisements do not want to invoke homosexual connotations to their advertisements by asking male

readers if they are attracted to the male subject of an advertisement. However according to these advertisements it is acceptable to directly draw the attention of both male and female readers to the appearance and attractiveness of a woman.

Another example of the importance of a woman's appearance even in scientific advertisements draws parallels between the perfect functioning of the equipment being sold and the perfect appearance of a woman. In this advertisement a portrait of a woman holding a gene card is shown. The text of the advertisement declares both the woman and the gene card to be a "timeless beauty." As the woman is not depicted as a scientist, her social value in this advertisement arises largely from her attractive appearance. She is used to illustrate the importance of beauty for women.

While the appearance of women is a particular focus of some advertisements, the appearance of men was by no means unimportant. However it was evident that often this appearance was more important for its functionality than purely as an object of admiration or consumption. For example, Da Vinci's Vitruvian Man was utilized in several advertisements. This imagery was used to scientifically represent an idealized human (male) body, with all of its inherent power and abilities. In these advertisements the male form was presented as an efficient machine rather than as an object of male sexual desire.

Consumerism

Although consumerism was an underlying theme in all advertisements due to their very nature, several advertisements featured consumerism in distinctly gendered manner. Women were closely associated with consumer activities.

In one notable advertisement, a White woman in a short red skirt and fishnet stockings is shown seated at a shoe store. Her body is cut off, as only her coquettishly crossed legs and feet, with their bright red nail polish, are visible. Twenty-three pairs of shoes surround her, indicating that she is unable to make a decision on which pair to select or that she simply must have them all. The advertisement text proclaims, “Shoes are like kinases. One is never enough.” The “more is better” philosophy displayed in this advertisement clearly draws attention to the role of the female as a consumer of goods, sometimes to excess. The woman in this advertisement is both feminine in appearance and highly sexualized. The “gatherer” or perhaps “shopaholic” role of the female is strongly emphasized.

Self-Sacrifice

Several advertisements clearly indicate that a key component to a successful and admirable scientific career is personal sacrifice. In these advertisements the self-sacrificing scientist is shown as openly contemplating the decision to delay gratification because he or she believes that greater rewards will come at a later time. Scientists are shown paying their dues in the present in order to attain a more successful career overall. The selfless behavior of the altruistic scientist is portrayed as ultimately benefiting both the individual scientist as well as society in general through future discoveries. The element of self-sacrifice for the greater good underscores the noble nature of science.

Rock Stars

The flipside of the self-sacrificing scientist is the rock star scientist. Advertisements featuring a rock star theme portray a far more glamorous and personally rewarding scientific lifestyle than that of the altruistic scientist. The overall focus of advertisements that draw upon rock star imagery is peak scientific performance. These advertisements sometimes also depict a scientific hero, authority or expert.

The glamorous life of a typical guitar-wielding rock star was displayed in a recurring advertisement. In this advertisement a young White male with long hair and snakeskin boots is shown playing his guitar enthusiastically in mid-kick. The advertisement text indicates that the technology for sale provides better scientific performance, as it can “Do for your RNA what electricity did for the guitar.” The masculine rock star stereotype is clearly present in this advertisement series.

Although rock stars were predominantly depicted as male, they were not universally White. One reoccurring variant of the rock star theme utilized scientific achievement rather than musical pursuit to portray the importance of professional scientific achievements. In this advertisement an Asian American male in a business suit was shown speaking authoritatively at a podium about an unspecified scientific discovery. The text of the advertisement indicates that “rock stars” are not only musicians, but also the scientists who are “... idealistic souls driven to discover something that will improve the human condition.” Notions of scientific discovery and masculine boldness characterize this advertisement. Science is glorified as it is

equated with both intellectual pursuits and a confident demeanor. The audacious performance of masculinity is connected to notable scientific achievements in advertisements featuring rock stars.

Summary

The quantitative data regarding sex, race, and identity/occupation communicates messages about the social stereotypes in the advertisements. The sex, race, and identity/occupation statistics reveal social messages about scientists and the practice of science. Gender and race are fundamental components of the various stereotypes. The perspective that reproduces these stereotypes in the advertisements does not challenge social inequality. Likewise, the impact on social location on the production of knowledge is invisible in the advertisements.

The advertisements in *Science* have to a certain extent moved away from stereotypical depiction of White male scientists. Portrayal of racial diversity and gender equality has increased compared to the 1995 through 1997 advertisements (Barbercheck, 2001). However, evidence of social inequality based on gender and race is still present. The racial proportion of scientists is more closely in line with the contemporary characteristics of scientists in the U.S. than was the case in 1995 through 1997. The White male scientist stereotype, and its androcentric connotations, is to a certain extent diluted by idealized depictions of equal numbers of male and female scientists. However, social stereotypes of scientists persist as male scientists of color are generally underrepresented. The “nerd” stereotype remains the almost exclusive domain of White males, perhaps as a reflection of sensitivity to portraying

obviously negative stereotypes of non-White races. Many non-scientific stereotypes, as of the male athlete and the female caregiver remain intact. Embodiment is central to the depiction of individuals in their stereotypical roles in the advertisements. As these stereotypes may reinforce social inequality, they are particularly problematic in a scientific journal.

General ideas about gender and race in society not directly relating to scientists specifically were clearly depicted. The male gaze constructs the way in which men and women are portrayed in the advertisements. A woman's attractiveness and sexual availability were important components in the way they were depicted. Heteronormativity was maintained in all advertisements. Self-sacrifice, as well as a degree of intellectual courage, was portrayed as desirable characteristics for scientists, particularly male scientists.

CONCLUSION

The advertisements in *Science* reflect stories that science tells about itself. Of course the advertisements do not reflect a true, impartial reality as it really is, but rather a manipulated representation of the world. The texts of these stories vary, but all individuals shown have social characteristics that can be analyzed in terms of their greater significance.

Postmodern feminist theory allows effective recognition of social stereotypes in advertisements; its focus on the social construction of knowledge allows an analysis of the stereotypes that highlights how they are reflective of social power. The theory focuses on the perspectives of women and people of color, but allows positive changes and trends to be recognized. Science in this theory always has the potential for positive change and impact through the full participation of men and women from diverse backgrounds. A rejection of the “God-trick” in science as outlined by Haraway, along with a more general recognition of the male gaze, would allow more diverse perspectives in science to operate.

Race and gender traits are important components to all social stereotypes, both positive and negative. In light of the challenges that women and people of color have faced in participation in science, race and gender remain principal factors for a successful scientific career. Advertisements increasingly acknowledge this challenge by electing to portray more racially diverse and gender-neutral scientists in the advertisements. A reduction of the most prominent and basic scientist stereotype, the

White male, parallels the increasing diversity of real scientists. However, race and gender continue to express the social status of and often the intellectual proficiency of the scientists in the advertisements.

The use of stereotypes in the advertisements is clearly connected to the message and motivation of the advertisement. The messages vary, but overall they reflect the traditional interests of patriarchy. Although depiction of diversity and equality is increasing, the race and gender stereotypes in the advertisements indicate covert support of conventional viewpoints that divide and rank different social groups. Along with different social groups, nature and culture are divided and ranked. The interests of White males are best represented in the advertisements as their control of nature and mastery of science is fully shown. The interests of women and people of color are not fully represented because they are not shown as full participants or equal competitors. However, women and people of color are shown in more positive ways than in the past.

Conventional notions of the relationship between men and women are not challenged in the advertisements. The relative social power held by the genders is also presented in a traditional manner. Racial diversity was shown to increase, but not in a manner that was threatening to White males as men of color were underrepresented. As women retained their lower social status and were objectified in the advertisements, the women of color represented a surface increase in diversity but simultaneously represented the continued operation of the male gaze. The persistence

of patriarchy was therefore demonstrated even in light of a superficial portrayal of increased equality between genders and races.

The stereotypes in the advertisements illustrated the social power associated with complex and interconnecting identities. Positive changes must be recognized, but not celebrated prematurely. In the stereotypes, gender and race influence other characteristics. Each shift in the portrayal of stereotypes is underlined by various elements of social power. Apparent weakening of negative stereotypes does not automatically signify attainment of equal social power because the foundation of social inequality has not been challenged.

Although reduction of negative stereotypes and a corresponding increase in the depiction of racial diversity and gender equality is certainly positive, these trends do not serve to demolish the patriarchal social structure that ensures continued social inequalities. In order for decreased androcentrism and increased racial diversity in the advertisements to have true impact on scientists and non-scientists alike there must be sustained awareness of social inequalities. Furthermore, members of all levels of society must decisively and continuously challenge it in order to institute meaningful change.

Recommendations for Further Research

This study has demonstrated that the use of social stereotypes in scientific advertisements is changing. Ideas about race and gender are, however, still relevant in the culture of science. Further research using scientific journals published in countries other than the U.S. would provide a valuable cross-cultural examination of stereotype

usage. Information on how gender and race are represented in scientific advertisements in different settings would offer insight to the perceived value of different groups of scientists. Alternatively, different source material, such as textbooks from different years, could also offer a means of assessing the stereotypical social characteristics of scientists. Lastly, an analysis of the advertisements in a field-specific scientific journal in comparison with the demographic information of that field would also highlight the connection between culture and science.

Additionally, an analysis of the advertisements in *Science* from a time period earlier than 1995 through 1997 would provide further information on the way stereotype usage has changed over time. In conjunction with the appropriate demographic information of the general population and of scientists, these data would allow a detailed review of the shift in the social profile of individuals in scientific advertisements. A general review of the changes in the iconography of science over time would also reveal information about the interaction of culture and science.

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