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Portrayals of Male and Female Scientists in Television Programs Popular Among Middle School–Age Children

Marilee Long,1 Jocelyn Steinke,2 Brooks Applegate,2 Maria Knight Lapinski,3 Marne J. Johnson,4 and Sayani Ghosh5

Abstract

This content analysis examined portrayals of scientist characters in 14 television programs popular among or likely to have been viewed by middle school–age children. While male scientists significantly outnumbered and appeared in significantly more scenes than did female scientists, males and females were depicted similarly in reference to professional position, marital status, and parental status. Gender-stereotyped behavior was largely absent in portrayals of scientist characters. Additionally, both male and female scientists were portrayed most often with the wishful identification attribute of intelligence. Implications for middle school–age children’s perceptions of scientists and for cultivating girls’ interest in science careers are discussed.

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Keywords

gender stereotypes, wishful identification, television, scientists, adolescents

Both formal and informal science education programs have been used to develop girls’ interest in science, engineering, and technology (SET). Programs that use mass media to develop girls’ interests in these fields may be particularly effective because adolescent girls report spending an average of 1.67 hours a day watching television (Cherney & London, 2006). Furthermore, research on middle school–age children indicates that television is a source of information about scientists (Steinke et al., 2007) and that television programs positively influence their attitudes toward science (Gibson & Chase, 2002).

Television may be an important socializing agent for adolescent girls (Behm-Morawitz & Mastro, 2008; Eggermont, 2004; Faber, Brown, & McLeod, 1979). Adolescence marks a critical time for girls when the “possible selves” they envision for themselves have great potential to influence their future behavior (Markus & Nurius, 1986). If television provides positive SET role models or other content suggesting that SET careers are appropriate for women, girls may incorporate that knowledge into visions of their possible selves, which, in turn, could influence their future career choices.

Two theoretical perspectives, gender schema theory and social cognitive theory, describe how socializing agents like television can help shape girls’ identities and visions of future possible selves.

Gender Schema Theory

Throughout childhood and into adolescence, children develop views about gender roles (Bem, 1981). They learn gender roles from a variety of socializing agents including parents, teachers, peers, and the media (Bandura, 2002; Bussey & Bandura, 1999). These gender roles, when internalized, become gender schemas that are central to children’s self-concepts and, consequently, direct their actions (Bem, 1981). These gender schemas include beliefs about gender-appropriate personal and professional roles. To the extent that society presents professional roles as gendered, children may perceive such roles as appropriate or inappropriate for themselves. Furthermore, to the extent that media used by children present such gendered roles, media may influence perceptions of gender “appropriateness.”

While several studies have documented the resistance of gender schemas to change (e.g., Durkin, 1985; Durkin & Nugent, 1998; Martin & Halverson,
some research also indicates that gender schemas are more flexible. For example, Eisenstock (1984) found that preadolescent and adolescent girls who identified originally with traditional feminine gender roles later identified with televised images of women in counter-stereotypical gender roles. Similarly, Aubrey and Harrison (2004) found that elementary school–age girls were attracted to female characters who did not exhibit traditional gender-stereotyped or feminine-stereotyped behavior. While some research indicates that gender schemas may be relatively flexible, the difficulty in using media to alter these schemas lies in the fact that media representations of female characters are largely traditional. Nonetheless, some studies of media depictions of female scientists have documented counter-stereotypical depictions of female scientists that may be helpful in dispelling misconceptions about scientists (e.g., Steinke, 1997, 1999).

**Social Cognitive Theory**

Social cognitive theory (Bandura, 1986) suggests that children may learn attitudes and behaviors, including gender schemas, from media characters. According to this theory, children learn cultural patterns of behavior through repeated observations of actual models, such as parents and teachers, and symbolic models, such as those depicted in the media.

As early as the 1950s, studies documented children’s ability to learn and model the behavior of television characters, particularly those with whom they shared similar traits (Bandura, Ross, & Ross, 1963a, 1963b; Maccoby & Wilson, 1957). More recent studies have found that children learn more from television when they identify with the characters depicted in the programming. These studies have documented the tendency for identification with same-sex characters (Calvert, Kotler, Zehnder, & Shockey, 2003; Calvert, Murray, & Conger, 2004; Reeves & Miller, 1978). Learning is particularly enhanced when children show wishful identification with same-sex characters and with characters with whom they share attitudes and attributes (Hoffner, 1996; Hoffner & Buchanan, 2005). According to J. D. Brown and Pardun (2004), “race and gender are basic motivators for choice of television content, and that adolescents may, indeed, be seeking models with whom they can identify as they develop a sense of themselves in the larger culture” (p. 275).

Research has also examined the attributes of televised characters that lead children and young adults to identify with them. In general, viewer gender and character gender attributes are strong determinants of identification. For example, 7- to 12-year-old children express wishful identification for
intelligent male characters; however, only girls express wishful identification with humorous male characters and attractive female characters (Hoffner, 1996). Similarly, in a study of young adults, Hoffner and Buchanan (2005) found that young adults identify with same-sex characters who are intelligent and successful, and they identify with opposite-sex characters who are successful and admired. The researchers also found that young women identify with female characters who are admired and attractive, while young men identify with male characters who are violent.

**Media Portrayals and Girls’ Perceptions of Scientists**

Studies indicate that few opportunities exist for girls to observe female scientist role models in U.S. media. Images of male scientists and engineers dominate most media programming (Leaper, Breed, Hoffman, & Perlman, 2002; Long, Boiarshy, & Thayer, 2001; Signorielli, 1993; Steinke & Long, 1996; Weingart, Muhl, & Pansegrau, 2003). When female engineers and scientists do appear, the portrayals typically reinforce gender stereotypes by downplaying females’ expertise (Corbett, 2001; LaFollette, 1981, 1988, 1990; Nelkin, 1987; Steinke & Long, 1996), focusing on conflicts women have in balancing their professional and personal lives (LaFollette, 1988, 1990), showing women as younger and more attractive than men (Weingart et al., 2003), showing women as lacking the skills needed to conduct scientific research (LaFollette, 1988), and emphasizing women as potential distractions to their male colleagues (LaFollette, 1990).

The differences in how male and female scientists are portrayed in the media are important to examine, because they may be linked to girls’ perceptions of scientific careers as not being compatible with the value they place on occupations that involve helping others (Jones, Howe, & Rua, 2000; Miller, Blessing, & Schwartz, 2006; Packard & Nguyen, 2003; Weisgram & Bigler, 2006), beliefs that scientific careers make having a family difficult (Miller et al., 2006), perceptions of the scientific lifestyle as being unattractive (Miller et al., 2006), and perceptions of scientists as violent (Miller et al., 2006) and predominantly male (Barman, 1997; Chambers, 1983; Fort & Varney, 1989; Knight & Cunningham, 2004).

Additionally, the popular perception of scientists as being “unusually intelligent, socially inept, and absent-minded ‘geeks’ or ‘nerds’” (Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development, 2000, p. 59) may work against girls’ identifying with scientist characters and perceiving science as a reasonable career path. Research on adolescent girls’ career choices suggests
that girls with strong math and science skills may have limited views of scientists that lead them to stereotype scientists and engineers “as nerds who focus on mechanical tasks with little direct human relevance” (Eccles, 2006, p. 204). Several researchers have documented the tendency of media to portray scientists as being eccentric and antisocial (Dunn, 1979; Gerbner, 1987; LaFollette, 1981; Nelkin, 1990) and as working long hours, often alone (Nelkin, 1990).

The Current Study

The current study adds to the literature by examining scientist characters in 14 television programs popular among or likely to have been seen by 12- to 14-year-olds, an age group that is vulnerable to losing interest in SET (American Association of University Women, 1998, 2000). In particular, this study updates our knowledge of the gender stereotyping and scientist stereotyping of scientist characters in a variety of television programs, and it is among the first to investigate the extent to which these characters exhibit attributes likely to encourage wishful identification in adolescent viewers.

The 14 programs in this study also represent four program genres (cartoon, drama, educational/demonstration, and situation comedy), permitting the investigation of the effect of TV program genre on portrayals of scientist characters. Research indicates that program genre is instrumental in understanding audience effects. For example, program genre is related to the amount and type of attention that viewers pay to television content (Hawkins et al., 2001; Hawkins et al., 2005) and the gratifications that viewers derive from television viewing (Hawkins et al., 2001). Of particular interest to the current study is the fact that program genre is related to viewers’ identification with television characters (Chory-Assad & Cicchirillo, 2005) and gender differences in children’s preference for television programs (Cherney & London, 2006).

As outlined previously in this article, evidence from several studies suggests that female scientist characters have a smaller presence in television programs than do male scientist characters. This gendered portrayal of science on television mirrors the greater presence of males in science and engineering occupations in the United States. According to Science and Engineering Indicators (National Science Board, 2008), women represent only 26% of all scientists in nonacademic settings and 31% in academic occupations at the doctoral level in 2005. Research suggests that male-centered practices, policies, systems, and values unconsciously create barriers for women in SET (Miller et al., 2006). Thus, we posed the following hypothesis:
Hypothesis 1: Male characters will be more likely to be depicted as scientists than will female characters.

For several years, the National Science Foundation (NSF) has funded programs that have worked to increase the presence of female scientists on television. Two of these programs, Bill Nye the Science Guy and DragonflyTV, are part of the current study. To our knowledge, the extent to which NSF-funded programs provide a more equitable distribution of male and female scientists than do non-NSF-funded programs has not been investigated. Thus, we posed the following research question:

Research Question 1: Do NSF-funded television programs provide a more balanced distribution of male and female scientist characters than non-NSF-funded programs?

Traditional cultural stereotypes represent women as subordinate to men in some professional fields. Similarly, some studies of mass media have found that female scientists are shown in subordinate positions to their male counterparts (e.g., Flicker, 2003; Steinke & Long, 1996), that is, females are cast as research assistants, technicians, or students as opposed to being portrayed as full-fledged scientists or science administrators. These portrayals of female scientists on screen reflect the distribution of women in the U.S. science and engineering workforce. Although recent increases in the number of females earning science and engineering doctoral degrees are expected to significantly increase the number of female scientists in more senior-level positions in the next decade (National Science Board, 2008), women are currently underrepresented at the top of SET professions (Valian, 2006). Because of this paucity of women in high-status science positions and based on evidence from previous studies of scientists’ status in media programming, we posed the following hypothesis:

Hypothesis 2: Male scientist characters will have higher status scientific positions than will female scientist characters.

The literature suggests that female scientist characters are more likely to have traditional gender role responsibilities related to family and childcare than are male scientist characters. For example, in a study of prime-time TV dramas from 1975 and 1979, Signorielli (1982) found that female characters were typically portrayed in home and family contexts, and they were more likely to be married than were male characters. More recently, Lauzen,
Dozier, and Horan (2008) analyzed prime-time television during the 2005-2006 season. They found that female characters were more likely to have roles related to romance, family, and friends, while male characters were more likely to have roles related to work. Based on this prior research, we posed the following hypotheses:

**Hypothesis 3:** Female scientist characters will be more likely to be married than will male scientist characters.

**Hypothesis 4:** Female scientist characters will be more likely to be parents than will male scientist characters.

Beyond these demographic characteristics, we compared the extent to which scientist characters on television exhibited some gender stereotypical behaviors. The gender-stereotyped attributes selected for this study were derived from research on gender stereotyping on television (Calvert et al., 2003), which had adapted these attributes from the Bem Sex-Role Inventory scale (Bem, 1974). Calvert et al. (2003) listed the following attributes as feminine: deferent-yielding-dependent, affectionate-warm-gentle-compassionate, romantic, body conscious, harm avoidant, and shy. For this study, the attribute labels were modified and the following attributes were coded as feminine: dependent, caring, and romantic. The attributes of body conscious, harm avoidant, and shy were not examined because few instances of these attributes were found in preliminary viewing of the television programs. Calvert et al. (2003) listed the following attributes as masculine: dominant-aggressive, autonomous-independent, analytic, competitive-ambitious, athletic, and heroic. For this study, the attribute labels were modified and the following attributes were coded as masculine: independent, athletic, and dominant. The masculine attributes of analytic, competitive-ambitious, and heroic were not investigated because few instances of these attributes were found in preliminary viewing of the television programs.

Based on the pattern of gender stereotyping noted in prior studies, which were discussed earlier in this article, we posed the following hypotheses and research question concerning these masculine and feminine attributes:

**Hypothesis 5:** Male scientist characters will be more likely to exhibit stereotypically masculine attributes (i.e., athletic, dominant, and independent) than will female scientist characters.

**Hypothesis 6:** Female scientist characters will be more likely to exhibit stereotypically feminine attributes (i.e., caring, romantic, and dependent) than will male scientist characters.
While it is likely that scientist character depictions will have some cross-program similarities (Gerbner, Gross, Morgan, Signorielli, & Shanahan, 2002), it is also likely that different television program genres will depict scientists somewhat differently. For example, it would be unlikely for cartoons to depict scientists identically to how they are depicted in dramas. To date, most studies of representations of scientists in the media have analyzed a single program genre, such as cartoons (LaFollette, 1981), educational television (e.g., Long et al., 2001; Steinke & Long, 1996), and science fiction films (e.g., Weingart et al., 2003). Studies that analyze multiple television program genres are important in assessing potential effects, because research indicates gender differences in children’s preferences for television programs. Boys report liking cartoons, situation comedies, entertainment shows, and more action-oriented shows, while girls report liking cartoons, entertainment shows, and teenage drama and people-oriented shows (Cherney & London, 2006). Thus, the following research question was posed:

**Research Question 2:** Do gender-stereotyped attributes of scientist characters vary by television program genre?

As discussed previously, the popular perception of scientists as being nerdy, geeky, and antisocial may negatively influence girls’ perceptions of scientists. We were interested in whether the “nerd/geek” stereotype and the “loner” stereotype were applied differentially to male and female scientist characters. Because adolescent girls wish to be popular (L. M. Brown & Gilligan, 1992; Orenstein, 1994), these unflattering stereotypes may dissuade them from pursuing careers in science. Because of the potential influence of these stereotypes, we posed the following research questions:

**Research Question 3:** Do male and female scientist characters differ in the extent to which they are labeled nerdy/geeky or are shown alone in scenes?

**Research Question 4:** Do scientist-stereotyped attributes (i.e., nerdy/geeky and alone in scenes) vary by program genre?

This study extends the research on wishful identification by assessing the extent to which scientist characters embody some of the wishful identification attributes that studies using self-report data show are important to viewers. We examined four wishful identification attributes: intelligent, caring, respect, and violent. Studies show that both males and females identify with
characters who are intelligent (Hoffner, 1996; Hoffner & Buchanan, 2005), exhibit prosocial behavior (Calvert et al., 2004), and are admired (Hoffner & Buchanan, 2005). Furthermore, males identify with male characters who are violent (Hoffner & Buchanan, 2005). In this study, respect was our measure of admiration (similar to Hoffner & Buchanan, 2005), and caring was our measure of a prosocial behavior. We tested the following hypotheses and research questions about wishful identification:

**Hypothesis 7:** Male and female scientist characters will be equally likely to be shown as intelligent, respected, and caring.

**Hypothesis 8:** Male scientist characters will be more likely to be violent than will female scientist characters.

**Research Question 5:** Do wishful identification attributes of scientist characters vary by television program genre?

**Method**

**Program Sample**

The sample consisted of television programs that contained scientist characters and were popular among or likely to have been seen by middle school–age children. The researchers identified these programs based on findings from a study that asked middle school–age children for television programs they watched that showed scientists (Steinke et al., 2007), Nielsen data on the most popular television programs among children aged 12 to 17 years (Nielsen Media Research, 2004), and a list of prime-time television science programs (National Science Board, 2006). Based on this information, 14 television programs were identified: *Bill Nye the Science Guy, CSI, CSI-Miami, CSI-New York, Danny Phantom, Dexter’s Laboratory, DragonflyTV, Friends, Kim Possible, MythBusters, Strange Days at Blake Holsey High, The Adventures of Jimmy Neutron: Boy Genius, The Simpsons*, and *The X-Files*.

To obtain the episodes for analysis, we randomly chose one episode of each program per week during April and May 2006. Twelve of the 14 programs were available in the local market during this time, and all but one program, *CSI-New York*,\(^1\) aired multiple times a week. During this 2-month period, the fact that 11 of the programs aired multiple episodes during a week increased the representativeness of our sample, because we were more likely to have chosen from among episodes that ran throughout the life of the program. *DragonflyTV* was not aired in the local market during the sampling period; however, copies of all episodes for the year and a half that the program

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\(^1\) CSI-New York aired multiple times a week during this time period.
had aired were obtained, and eight episodes were randomly chosen. *Bill Nye the Science Guy* was no longer being broadcast at the time of the study. However, all episodes of this program are available for purchase, so eight episodes were randomly selected from the program’s entire run. In all, 112 episodes were analyzed.

**Scientist Character Identification**

To be considered a scientist, a character had to be human, appear on screen and speak, and meet one of the following criteria: (a) self-identify as a scientist or be identified by another character as a scientist, (b) wear a laboratory coat, or (c) perform at least two of the following scientific activities—conduct an experiment, collect scientific samples for analysis, or discuss scientific phenomena. Intercoder reliability for identifying scientist characters was assessed using two trained coders who independently coded one randomly selected episode of each program (see Table 1). In all, 196 unique scientist characters were identified in the sample.

**Scene Identification**

For this study, the extent to which each unique scientist character exhibited gender-stereotyped, scientist-stereotyped, and wishful identification attributes was determined by counting the number of scenes in which each scientist character demonstrated the attribute. Thus, while the unit of analysis for these three types of attributes was the individual scientist character, the unit of observation was the “scene,” which had to be reliably identified.

A scene was defined as a set of actions taking place in a single location (e.g., a kitchen, a car) and time (e.g., morning, evening). A scene, therefore, began and ended when there was a change in the location of the action or a change in time. To assess intercoder reliability for scene identification, trained coders independently identified scenes in one randomly selected episode of each program. Because scene changes might manifest themselves differently across the variety of programs in the sample, intercoder reliability for scenes was assessed in three groups: live-action, narrative programs (*CSI, CSI-New York, CSI-Miami, X-Files, Strange Days at Blake Holsey High, and Friends*), animated programs (*Dexter’s Laboratory, The Simpsons, Kim Possible, The Adventures of Jimmy Neutron: Boy Genius, and Danny Phantom*), and science education and demonstration programs (*Myth-Busters, DragonflyTV, and Bill Nye the Science Guy*). Intercoder reliability was acceptable (see Table 1).
Table 1. Reliability Analysis for All Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reliability^a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientist character</td>
<td>.81</td>
</tr>
<tr>
<td>Scene identification</td>
<td></td>
</tr>
<tr>
<td>Live-action, narrative</td>
<td>.82-.87^b</td>
</tr>
<tr>
<td>Animated</td>
<td>.72</td>
</tr>
<tr>
<td>Education/demonstration</td>
<td>.90</td>
</tr>
<tr>
<td>Demographic attributes</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>.77</td>
</tr>
<tr>
<td>Biological sex</td>
<td>.91</td>
</tr>
<tr>
<td>Marital status</td>
<td>.65</td>
</tr>
<tr>
<td>Parental status</td>
<td>.63</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>.77</td>
</tr>
<tr>
<td>Scientific job status</td>
<td>1.00</td>
</tr>
<tr>
<td>Feminine attributes</td>
<td></td>
</tr>
<tr>
<td>Caring</td>
<td>.72</td>
</tr>
<tr>
<td>Dependent</td>
<td>.66</td>
</tr>
<tr>
<td>Romantic</td>
<td>.80</td>
</tr>
<tr>
<td>Masculine attributes</td>
<td></td>
</tr>
<tr>
<td>Athletic</td>
<td>.62</td>
</tr>
<tr>
<td>Dominant</td>
<td>.72</td>
</tr>
<tr>
<td>Independent</td>
<td>.68</td>
</tr>
<tr>
<td>Scientist attributes</td>
<td></td>
</tr>
<tr>
<td>Nerdy/geeky</td>
<td>.80</td>
</tr>
<tr>
<td>Alone in scene</td>
<td>.83</td>
</tr>
<tr>
<td>Wishful identification attributes</td>
<td></td>
</tr>
<tr>
<td>Caring</td>
<td>c</td>
</tr>
<tr>
<td>Intelligent</td>
<td>.68</td>
</tr>
<tr>
<td>Respect</td>
<td>.66</td>
</tr>
<tr>
<td>Violent</td>
<td>.66</td>
</tr>
</tbody>
</table>

^aCohen’s kappa and Scott’s pi were used to assess intercoder reliability. Both of these statistics adjust for chance agreement.

^bA range is provided because multiple coding pairs participated in the reliability work.

^cSee entry for “Caring” under “Feminine attributes.”

Attribute Coding

Each scientist character was coded for the following demographic and lifestyle characteristics: biological sex, race/ethnicity (coded into six categories), age (adult, teenager or young adult, or child),^4 professional status in the scientific workforce (scientist or researcher; science administrator; or science student, research assistant, or technician), marital status (married or unmarried),
and parental status (with children or without children). Two trained coders worked independently to code one episode of each program in order to assess the intercoder reliability of these variables (see Table 1).

In addition to the preceding variables, we determined the number of scenes in which a scientist character exhibited gender-stereotyped behavior. We examined three feminine stereotypical attributes: dependent, caring, and romantic. Characters were dependent when they relied on others for assistance (e.g., asked other characters for help, were unable to accomplish a task without help). Characters demonstrated caring when they exhibited behaviors or made statements designed to comfort or help others (e.g., fed a character who was hungry, expressed sympathy for another character’s plight, offered to help another character). Characters were coded as romantic when they expressed feelings of intimate attraction toward other characters (e.g., stated that they loved another character) or demonstrated feelings of intimate attraction to another character through their actions (e.g., kissed or held hands with another character).

We also investigated three masculine stereotypical attributes: independent, dominant, and athletic. Characters were independent when they made statements or performed actions indicating that they were not relying on others for assistance or advice, or when they refused to follow another character’s instructions. Characters were dominant when they exerted authority or influence over others (e.g., told or showed other characters what to do; told other characters that they were wrong). Characters were athletic when they participated in a physical activity that demonstrated strength and/or stamina, talked about participating in such an activity, or were shown wearing athletic attire.

Two scientist stereotypical attributes were investigated in this study: being labeled as nerdy/geeky and being alone. To be considered nerdy/geeky, a scientist character had to self-identify as such or had to be called nerdy or geeky by another character or by a voice-over. A scientist character was considered alone in a scene if he or she was the only living person in the scene and was not interacting with other living humans (e.g., the scientist character was not talking on the telephone, was not engaged in instant messaging with someone off screen, and was not interacting with an offscreen voice). A scientist character was also considered alone in a scene if he or she was in a scene with other people but was not interacting with those people.

We also determined the number of scenes in which scientist characters exhibited four wishful identification attributes: intelligent, caring, respect, and violent. Characters were intelligent when they made factual statements or offered opinions about why a phenomenon may have happened, explained
how a process worked, explained or used specialized terminology, offered suggestions on how to proceed with an experiment, or used scientific equipment to analyze material. Respect was exhibited toward a scientist when another character showed deference toward the scientist character (e.g., asked the scientist’s opinion or for advice, complimented the scientist, or when the scientist was given an award). Characters were violent when they used physical force or threatened to use physical force toward people, animals, or property with the purpose of inflicting physical damage. The motivation for the violence was irrelevant. The definition of caring was provided earlier in this article.

To assess intercoder reliability for scientist characters exhibiting gender-stereotyped attributes, scientist-stereotyped attributes, and wishful identification attributes within scenes, trained coders coded all scientists who appeared within a randomly selected 15-minute portion of a randomly selected episode of each program. Intercoder reliability statistics for these variables are presented in Table 1.

## Results

Of the 196 scientist characters identified in this study, 113 (58%) were male and 83 (42%) were female. Nearly three-fourths (72%) were White/Caucasian, and the majority were adults (56%) followed by young adults/teenagers (25%), and children (19%).

Hypothesis 1 predicted that male scientist characters would have a larger presence in programs than would female scientist characters. This hypothesis was supported. There were significantly more male scientist characters \(n = 113\) than female scientist characters \(n = 83\), \(\chi^2(1) = 4.59, p < .05\). Furthermore, across all programs, male scientist characters were in significantly more scenes \(M = 23.7\) scenes) than were female scientist characters \(M = 15.1\) scenes), \(t(184.94) = 8.68, p < .05\).5

To test research questions posed about program genre, the 14 programs were grouped into four genres (Table 2). Situation comedies were removed from research question analyses because this genre contained only five scientists. The number of scientist characters in the other program genres was as follows: cartoon = 16, drama = 62, and education/demonstration = 113.

Research Question 1 asked whether NSF-funded programs provided a more equitable gender distribution of scientist characters than non-NSF-funded programs. Results indicated that NSF programs did create a more balanced picture, \(\chi^2(1) = 12.45, p < .05\). The NSF programs contained 52 female scientist characters and 42 male scientist characters, while the
non-NSF programs contained 31 female scientist characters and 71 male scientist characters.

Hypothesis 2, which predicted that male scientist characters would have higher status scientific positions than would female scientist characters, was not supported, $\chi^2(1) = 1.04, p = 0.31$. For males, 80.5% were in high-status scientific positions (i.e., classified as a scientist or researcher), and 74.4% of females were in high-status scientific positions.$^6$

Hypothesis 3, which predicted more female scientist characters would be married than would male scientist characters, was not supported. In fact, for the 42 adult and young adult scientist characters for which marital status could be determined, more males ($n = 12$) were portrayed as married than females ($n = 8$). Also, Hypothesis 4 was not supported. Counter to our prediction, more adult and young adult male scientist characters ($n = 8$) were portrayed as parents than were adult and young adult female scientist characters ($n = 5$).

Hypotheses 5 and 6 investigated the extent to which portrayals of scientist characters were gender stereotyped. To test these hypotheses, we used the mean percentage of scenes in which a gender-stereotyped attribute was present as the dependent variable, to control for the fact that males were in more scenes than were females. Also, each gender-stereotyped attribute was tested individually because scales for the female attributes (i.e., dependent, caring, and romantic) and the male attributes (i.e., dominant, independent, and athletic) were not reliable. Finally, the Mann-Whitney $U$ statistical test was used for Hypotheses 5 and 6 because the data were not normally distributed. As Table 3 shows, male scientist characters were significantly more likely to be portrayed as independent than were female scientist characters, thus providing some support for Hypothesis 5. In contrast, no support was found for Hypothesis 6; female and male scientist characters were equally likely to

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**Table 2. Television Programs Categorized by Program Genre**

<table>
<thead>
<tr>
<th>Cartoon</th>
<th>Drama</th>
<th>Education/Demonstration</th>
<th>Situation Comedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danny Phantom</td>
<td>CSI</td>
<td>Bill Nye the Science Guy</td>
<td>Friends</td>
</tr>
<tr>
<td>Dexter’s Laboratory</td>
<td>CSI-Miami</td>
<td>DragonflyTV</td>
<td></td>
</tr>
<tr>
<td>Kim Possible</td>
<td>CSI-New York</td>
<td>MythBusters</td>
<td>The Simpsons</td>
</tr>
<tr>
<td>The Adventures of Jimmy Neutron: Boy Genius</td>
<td>Strange Days at Blake Holsey High The X-Files</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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show the feminine gender-stereotyped behaviors of caring, dependent, and romantic.

Research Question 2 investigated whether gender stereotypical behaviors varied by television program genre. To answer this research question, a Scheirer-Ray-Hare two-way ANOVA of ranks was performed, because the data were not normally distributed. This test is more powerful than standard $t$ tests when data are not normally distributed (Scheirer, Ray, & Hare, 1976). As Table 4 shows, gender stereotypical behavior did not differ by program genre.

Hypotheses and research questions about scientist-stereotyped attributes were also tested using nonparametric statistical tests because the data were not normally distributed. Research Question 3 asked whether male and female scientist characters varied in the extent to which they were labeled as nerdy or geeky and the extent to which they were shown alone in scenes. As shown in Table 3, male scientist characters were labeled as nerdy or geeky significantly more often than were female scientist characters; however, the groups did not differ in the extent to which they were shown alone in scenes. Results for Research Question 4 indicated that, while program genres were equally likely to show scientist characters alone in scenes (Table 5), they did

Table 3. Gender-Stereotyped and Scientist-Stereotyped Attributes for Male and Female Scientists

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Male Scientist ($n = 113$)</th>
<th>Female Scientists ($n = 83$)</th>
<th>Mann-Whitney $U$ Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean % of Scenes</td>
<td>Standard Deviation</td>
<td>Mean % of Scenes</td>
</tr>
<tr>
<td>Feminine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caring</td>
<td>2.0</td>
<td>0.05</td>
<td>3.9</td>
</tr>
<tr>
<td>Dependent</td>
<td>1.4</td>
<td>0.06</td>
<td>0.9</td>
</tr>
<tr>
<td>Romantic</td>
<td>1.6</td>
<td>0.07</td>
<td>3.5</td>
</tr>
<tr>
<td>Masculine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Athletic</td>
<td>7.8</td>
<td>0.23</td>
<td>9.0</td>
</tr>
<tr>
<td>Dominant</td>
<td>19.7</td>
<td>0.25</td>
<td>15.7</td>
</tr>
<tr>
<td>Independent</td>
<td>4.5</td>
<td>0.11</td>
<td>2.5</td>
</tr>
<tr>
<td>Scientist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone in scene</td>
<td>14.0</td>
<td>0.27</td>
<td>16.0</td>
</tr>
<tr>
<td>Nerdy/geeky</td>
<td>1.0</td>
<td>0.04</td>
<td>0.0</td>
</tr>
</tbody>
</table>

*p < .05.
vary on the extent to which scientist characters were called nerdy or geeky—this labeling occurred most often in cartoons.

Hypotheses 7 and 8 and Research Question 5 examined the extent to which the portrayals of male and female scientist characters exhibited some wishful identification attributes. As Table 6 shows, male and female scientist characters did not differ significantly for intelligent, respect, and caring attributes; however, male scientist characters were portrayed as more violent than were female scientist characters. Additionally, the distribution of wishful identification attributes varied by program genre for all four attributes (see Table 7); however, program genre and gender did not interact to predict the distribution.7

**Table 4. Gender-Stereotyped Attributes of Male and Female Scientists by Program Genre**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Cartoon Female (n = 4)</th>
<th>Cartoon Male (n = 12)</th>
<th>Drama Female (n = 23)</th>
<th>Drama Male (n = 39)</th>
<th>Education/Demonstration Female (n = 55)</th>
<th>Education/Demonstration Male (n = 58)</th>
<th>Scheire-Ray-Hare Two-Way ANOVA Test of Ranks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feminine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caring</td>
<td>3.5</td>
<td>3.2</td>
<td>8.7</td>
<td>3.8</td>
<td>1.8</td>
<td>0.4</td>
<td>.21</td>
</tr>
<tr>
<td>Dependent</td>
<td>4.6</td>
<td>4.4</td>
<td>2.0</td>
<td>0.5</td>
<td>0.0</td>
<td>0.2</td>
<td>.03</td>
</tr>
<tr>
<td>Romantic</td>
<td>2.9</td>
<td>5.9</td>
<td>11.5</td>
<td>1.2</td>
<td>0.3</td>
<td>0.0</td>
<td>.47</td>
</tr>
<tr>
<td>Masculine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Athletic</td>
<td>0.0</td>
<td>4.6</td>
<td>0.3</td>
<td>0.3</td>
<td>13.5</td>
<td>14.0</td>
<td>.18</td>
</tr>
<tr>
<td>Dominant</td>
<td>36.1</td>
<td>32.1</td>
<td>29.3</td>
<td>22.8</td>
<td>8.8</td>
<td>15.1</td>
<td>.25</td>
</tr>
<tr>
<td>Independent</td>
<td>10.1</td>
<td>19.0</td>
<td>7.1</td>
<td>4.7</td>
<td>0.0</td>
<td>0.0</td>
<td>.25</td>
</tr>
</tbody>
</table>

**Table 5. Scientist-Stereotyped Attributes by Program Genre**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Cartoon</th>
<th>Drama</th>
<th>Education/Demonstration</th>
<th>Kruskal-Wallis Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alone in scene</td>
<td>8.0</td>
<td>6.0</td>
<td>21.4</td>
<td>3.35</td>
</tr>
<tr>
<td>Nerdy/geeky</td>
<td>2.6</td>
<td>1.0</td>
<td>0.0</td>
<td>20.43*</td>
</tr>
</tbody>
</table>

*p < .05.
Discussion

The research findings describe the portrayals of scientist characters in television programs popular among or likely to have been viewed by middle school–age children. Consistent with other studies, the typical scientist character in these programs was an unmarried Caucasian man who did not have children, held a high-status science position, and was likely to be portrayed as being intelligent.

The overall dominance of male scientist characters, both in number of characters and in number of scenes, mirrors what other researchers have found (e.g., Long et al., 2001; Signorielli, 1993; Steinke & Long, 1996), and it continues to suggest to viewers that science is a career primarily for men. One exception to this pattern was found for NSF-funded programs, in which female and male scientist characters were more equally presented than they were in other programs. This result is encouraging, especially if girls watch these NSF-funded programs. Furthermore, these NSF-funded programs...
provide an opportunity for researchers interested in studying gender schema flexibility to examine whether programs with a higher female scientist presence can produce results similar to those reported by Eisenstock (1984) and Aubrey and Harrison (2004).

Although shown less frequently, the typical female scientist character in these programs was portrayed similarly to her male counterpart—she was an unmarried, Caucasian adult who did not have children, held a high-status science position, and was likely to be portrayed as intelligent. The finding that female and male scientist characters were equally likely to hold high-status positions is similar to depictions found in popular films (Steinke, 2005), but it differs from the pattern found in an earlier study of children’s educational television programs in which female scientists were more likely to be portrayed in secondary roles such as research assistants and students (Steinke & Long, 1996). The equity in scientific community status for female and male characters found in this study is encouraging and suggests greater breadth in the roles for female scientist characters in current television programming.

This study’s findings that adult female scientist characters were no more likely than adult male scientist characters to be identified as married or as parents indicate a departure from traditional gender stereotyping. Research on television dramas from the 1990s found that married women on these programs were portrayed with fewer options, “for they can rarely successfully combine marriage and employment” (Signorielli & Kahlenberg, 2001, p. 20). While the findings from the current study suggest television programs are portraying greater gender equity in the areas of marriage and family, these results should be interpreted with caution because of the small number of references to scientist characters’ marital and parental status. Furthermore, the lack of attention to work and family issues for scientist characters, male or female, reinforces the stereotype of scientists as individuals who devote themselves to their professional work at the expense of their personal lives. It is possible that these characterizations of scientists as not having personal relationships and families may unintentionally keep adolescent girls, who are already thinking about how to balance future professional and family roles (Archer, 1985) and who believe that scientific careers make having a family difficult (Miller et al., 2006), from seeing science as a viable career (Spelke & Grace, 2006). Furthermore, from a gender schema standpoint, it may be particularly important for girls to see female characters who are successful scientists and who have fulfilling personal lives.

The analysis of the gender-stereotyped attributes showed a small amount of gender stereotyping of male scientist characters. Male scientist characters were more likely than female scientist characters to exhibit the masculine
attribute of being independent. However, male and female scientist characters were equally likely to be shown exhibiting the masculine attributes of dominance and athleticism. For the feminine gender-stereotyped attributes (i.e., dependent, caring, and romantic), there were no differences between female and male scientist characters. These findings are counter to Leaper et al.’s (2002) study of several genres of children’s programs in which they found that female characters were more likely than male characters to be shown as romantic and supportive. Similarly, a recent study of prime-time television programs found female characters were more likely to be shown in interpersonal roles that focused on romance, family, and friends, while male characters were more likely to be shown in work-related roles (Lauzen et al., 2008). While it is encouraging to see these counter-stereotypical depictions, their potential influence should be considered with caution. Girls may not notice them because these portrayals may be overwhelmed by the much larger presence of male scientist characters in these programs. Additional research is needed to assess whether girls notice the limited number of televised images of female scientist characters, particularly those displaying counter-stereotypical gender attributes. Furthermore, if girls do notice these counter-stereotypical female characters, are they present in sufficient amounts to affect girls’ gender schemas for scientists?

The results from the investigation of the two scientist-stereotyped attributes were encouraging. It is clear from the data that both male and female scientist characters were seldom identified as nerdy or geeky, a welcome departure from popular perceptions of scientists. Likewise, the programs did not perpetuate the stereotype of scientists as loners. By presenting scientists as more mainstream, these counter-stereotypical depictions may encourage adolescent girls, who wish to be popular (L. M. Brown & Gilligan, 1992; Orenstein, 1994), to think more positively about SET careers.

Results from the wishful identification analysis provided a mixed picture of the potential for viewers to connect with scientist characters on television. By far, scientist characters in this study were most likely to be portrayed as being intelligent, which should encourage identification for both boy and girl viewers (Hoffner & Buchanan, 2005). Although this emphasis on the intelligence of scientist characters would be expected given the types of programs in this study, it also suggests that the stereotype of the “smart” scientist is overriding the gender stereotype of the “dumb” female. The other wishful identification attributes investigated in this study were present much less frequently; their low presence suggests that they will be less likely to affect viewers’ identification with scientist characters. Although the effects may be more subtle, future research should assess whether these less frequently
appearing attributes influence adolescents’ wishful identification with scientist characters. Of the attributes that were found less frequently in portrayals of scientists, the caring attribute may hold the most potential for encouraging adolescent girls to identify with scientist characters because adolescent girls report being interested in careers that provide opportunities for them to help others (Eccles, 2006).

Results from the program genre analysis of wishful identification attributes identified differences in how scientist characters were portrayed. Of the three program genres investigated in this study, drama programs may be the most likely to engender wishful identification among viewers because scientist characters in these programs exhibited relatively high levels of intelligence and respect. Future research on program genre differences is important because studies indicate gender differences in children’s preference for television programs; boys report liking cartoons, situation comedies, entertainment shows, and more action-oriented shows, while girls report liking cartoons, entertainment shows, and teenage drama and people-oriented shows (Cherney & London, 2006).

A limitation of this study was the fact that only six gender-stereotyped attributes, two scientist-stereotyped attributes, and four wishful identification attributes were examined. Future studies could expand on this line of research by examining a greater number of these attributes. These expanded efforts would provide researchers with a more complete picture of how scientist characters are portrayed in these programs and, ultimately, help determine the full list of attributes that may promote girls’ identification with scientist characters. Additionally, while this study is one of the few to examine multiple television genres, more research is needed in this area, both to expand the number of genres examined (e.g., reality television, action/adventure) and the variety of programs within genres. Finally, this study was limited because it did not compare the depictions of scientist characters with other characters in the programs. Thus, this study cannot comment on whether scientist characters were portrayed more positively or negatively than other characters.

Overall, the fact that male scientist characters had a larger screen presence, were more likely to be portrayed as violent (which research shows is a wishful identification attribute for boys), and were more likely to be portrayed as independent (a stereotypically male behavior) suggests that these television programs provided fewer opportunities for girls’ wishful identification with and social learning from scientist characters than they did for boys. Future research could investigate whether substantially increasing the presence of female scientist characters, particularly when those characters are portrayed as balancing work and family roles and are shown caring for
others, promotes girls' social learning, wishful identification, and gender schema modification about scientists. Research has found that adolescent girls are unlikely to consider careers that are counter to their gender roles or gender schemas; this propensity may lead them to eliminate SET careers if they view these careers as incompatible with future family role plans (Valian, 2006). Presenting more positive depictions of scientists on television, especially of female scientists, may be a particularly effective strategy for motivating girls to consider SET careers. Researchers have acknowledged that adolescents rely primarily on media portrayals and information from parents, mentors, and friends because of the lack of career information provided in American culture (Eccles, 2006).

Authors’ Note

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Notes

1. At the time of this study, CSI-New York was only broadcasting one episode per week in the local TV market.
2. For this study, we defined a scientist broadly to include scientists, engineers, research assistants, and teachers of science and engineering.
3. Researchers do not agree on what constitutes an acceptable level of chance-corrected intercoder reliability. Hayes (2005) suggests that levels as low as .70 are acceptable, while Krippendorff (2004) suggests levels as low as .667, when the research is more exploratory in nature. Landis and Koch (1977) suggest the following guidelines for using Cohen’s $k$: .41 to .60 = moderate agreement, .61 to .80 = substantial agreement, and .81 to 1.0 = almost perfect agreement. Because many of the variables used in this study were latent measures and were inherently difficult to measure, we adopted less stringent standards for reliability that are in line with the suggestions of Landis and Koch (1977).

4. Adult characters were defined as in their mid-20s or older; teenage or young adult characters were defined as in their teens or early 20s; children were defined as younger than 13 years of age.

5. The degrees of freedom for this hypothesis test were adjusted because Levene’s test for equality of variances indicated that the variances in the two samples were not equal.

6. No characters were classified as “science administrators,” and one character was classified in the “cannot determine scientist status” category and was dropped from this analysis.

7. Using the Scheirer-Ray-Hare test of ranks, we obtained the following null results for the interaction of gender and program genre: intelligent = .17, respect = .08, violent = .77, and caring = .21.

References


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