Cultural Representations of Gender and Science : Portrayals of Female Scientists and Engineers in Popular Films

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Images of female scientists and engineers in popular films convey cultural and social assumptions about the role of women in science, engineering, and technology (SET). This study analyzed cultural representations of gender conveyed through images of female scientists and engineers in popular films from 1991 to 2001. While many of these depictions of female scientists and engineers emphasized their appearance and focused on romance, most depictions also presented female scientists and engineers in professional positions of high status. Other images that showed the female scientists and engineers' interactions with male colleagues, however, reinforced traditional social and cultural assumptions about the role of women in SET through overt and subtle forms of stereotyping. This article explores the significance of these findings for developing programs to change girls' perceptions of scientists and engineers and attitudes toward SET careers.

Keywords: *gender and science; cultural representations of gender; female scientists and engineers; popular films*

The mass media convey and reinforce cultural assumptions about the lives and role of women in American society. Adolescent girls see many different images of women as they watch their favorite programs on television, flip

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through advertisements and illustrations in teen magazines, surf Web sites on the Internet, and watch movies on videotapes or DVDs or in movie theaters. These media images are small snapshots or portraits of women assuming roles that have been culturally defined as appropriate and acceptable for women in American society.

Girls grow up in a media-rich environment filled with images that reinforce cultural norms of femininity. Before girls reach adolescence, the time when most begin to develop individual identities and prepare for future roles, they are likely to have seen countless media images of women that emphasize feminine qualities and urge conformity to traditional stereotypes. Years of research examining media content, in fact, have documented many stereotypical images of women in a variety of media (Baker-Sperry and Grauerholz 2003; Coltrane and Messineo 2000; Dietz 1998; Dundes 2001; Elasmar, Hasegawa, and Brain 1999; Henke, Umble, and Smith 1996; Hoerner 1996; Johnston and Swanson 2003; Larson 1996; Lauzen and Dozier 1999; Massoni 2004; Pierce 1993, 1997; Signorelli 1997; Turner-Bowker 1996; Valdivia 1998).

Although images of women in the media have improved in recent years, many still focus on female characters that appear to be more concerned about appearance and romance than academics or careers. While some media images portray girls and women as strong characters, showing them as independent, intelligent, honest, direct, and capable of solving their own problems, many more media images reinforce traditional stereotypes of girls and women as dependent, passive, and emotional (Signorelli 1997).

The amount of time children spend using the media each day and their increasing dependency on the media for information during the adolescent years clearly underscores the importance of the media as pervasive and influential socializing agents in the lives of many children (Faber, Brown, and McLeod 1979; Signorelli 1997). Research indicates that children first begin to watch television between the ages of two and a half and three years (Comstock and Scharrer 2001). Furthermore, according to a major national study conducted for the Kaiser Family Foundation (1999), children aged eight to eighteen spend an average of six hours and forty-three minutes using media each day. The media become even more important sources of influence as children enter adolescence and begin to assert their independence from their parents (Signorelli 1997). During this time, adolescents are more likely to look to the media for information on specific "life tasks" that have the greatest salience to them: developing a gender-role identity, learning how to interact with members of the opposite sex, and selecting an occupation and other future life roles (Faber, Brown, and McLeod 1979).

During the adolescent years, the media are important sources of information about gender roles. During this time of transition from childhood to

adulthood, many girls experience a loss of self-confidence and become preoccupied with being popular and fitting in, looking thin and attractive, and finding romance (Brown and Gilligan 1992; Orenstein 1994). Many adolescent girls find that acting feminine is a way to gain approval, acceptance, and popularity and to avoid conflict (Brown and Gilligan 1992). Preadolescent and adolescent girls start to think more about gender roles as they begin to explore future roles for themselves. In developing identities or senses of self, girls try on different roles as they envision different "possible selves" (Ruvolo and Markus 1992, 95), which represent what they "could become, would like to become, and are afraid of becoming" (Ruvolo and Markus 1992, 95). Girls' current representations or visions of self guide their behavior and affect their performance in a number of ways (Ruvolo and Markus 1992).

The media images of women that girls are most likely to see during the time of identity formation reinforce traditional conceptions of femininity by providing stereotypical images of women (Signorelli 1997) that can limit girls' visions of "possible selves" (Ruvolo and Markus 1992, 95). During the preadolescent and adolescent years, when girls are preoccupied with being popular and attractive, they also are more likely to be influenced by media images of women that emphasize traditional feminine characteristics and roles (Beuf 1974; Morgan 1982).

Research suggests that a better understanding of cultural representations of women, specifically a better understanding of the portrayals of female scientists and engineers in the media, may enhance the efficacy of efforts to promote the greater representation of girls in science, engineering, and technology (Science, Engineering and Technology (SET); Steinke 1997, 1998, 2004). Despite the proliferation of science and engineering intervention programs for girls (National Science Foundation 2003) and recent increases in the participation of girls and women in science and engineering, women still are underrepresented in SET. Statistics indicate that women make up only 19.4 percent of the SET workforce, and women from all underrepresented minorities make up an even smaller percentage of the workforce in these areas (National Science Foundation 2000). Gender differences in participation in science courses seem to first appear in high school, with fewer women than men taking college-level Advanced Placement examinations in calculus, computer science, chemistry, and physics (College Board Online 1997).

The connection between cultural representations of gender and the gender gap in SET appears to be an important consideration because of the time period when girls first lose interest in these subject areas. Research shows that most girls first report a loss of interest in SET during the middle school years, around the age of twelve (American Association of University Women

1998, 2000), the same age at which many girls show a heightened awareness of gender roles (Erkut et al. 1999; Orenstein 1994). These events also coincide with the time when the media become more influential sources of information about gender for adolescents (Faber, Brown, and McLeod 1979). As adolescent girls begin making future plans during identity formation, they face an unfortunate convergence of events: girls begin making plans that affect their future at a time marked by waning self-confidence and a heightened awareness of cultural norms of femininity.

This study focuses on the cultural representations of gender conveyed though images of female scientists and engineers in popular films from 1991 to 2001. While several studies have looked at images of female scientists and engineers on television (Long, Boiarsky, and Thayer 2001; Steinke 1997; Steinke and Long 1996) and the World Wide Web (Steinke 2004), few studies have looked at images of female scientists in popular films (Flicker 2003; Steinke 1999). Films are a particularly important medium to examine because a review of the most popular television programs, movie videos, magazines, and books among preadolescent and adolescent children as identified in preliminary findings in *Getting the Media Message* (Bernt, Bernt, and Turner 2003a, 2003b) and findings in *A Content Analysis: Reflections of Girls in the Media* (Signorelli 1997) indicates that images of scientists are more likely to appear in popular films than in the other media used by this age group.

Examining images of female scientists in the mass media is an important first step in understanding the role these images may play in shaping adolescent girls' perceptions of scientists and engineers and their perceptions of careers in SET. Documenting the images adolescent girls see and determining the ways these images define women's roles provide information about the messages these portrayals convey about cultural assumptions about women in SET. Future research will address the impact of these images on preadolescent and adolescent girls' perceptions of scientists and engineers and careers in science and engineering.

A comparison of representations of female and male scientists and engineers in these films also is another important direction for future research. Examining the stereotypical and counter-stereotypical representations of both male and female scientists and the ways in which these may vary is important for advancing our understanding of the impact of these images on preadolescent and adolescent children's perceptions, attitudes, and interest in science and engineering careers. This research is critical for identifying specific strategies for interventions to encourage interest in science and engineering careers that are needed to address the current critical shortage of scientists and engineers in the U.S. workforce. Future research by the author is

in progress to compare representations of female and male scientists and engineers in films from 1991 to 2001 (see Appendix A).

Literature Review

Adolescence, Identity, and Gender

Adolescence has been described as a tumultuous time for girls, when they face an array of psychological, social, behavioral, cognitive, and physical changes (Phillips 1998). Adolescence is the time when many girls first begin to develop identities or self-images (Slater and Tiggemann 2002). Girls' current representations of self, or their "working self-concepts" (Ruvolo and Markus 1992, 95), guide their behavior and influence the choices they make (Ruvolo and Markus 1992).

During identity formation, many girls experience heightened awareness of gender and of social expectations for their gender. This "gender role intensification" (Hill and Lynch 1983; Huston and Alvarez 1990) often stems from increased pressure from parents to adhere to traditional gender roles and to fit into traditional dating roles (Tenenbaum and Leaper 2003). Growing up in a "gender-polarized society" (Bem 1994), girls learn to view themselves and others through the "lenses of gender" (Bem 1993). Many children grow up accepting traditional stereotypes of women that portray women as passive, emotional, physically weak, helpless, giving, expressive, dependent, and concerned with social roles and family obligations (Archer 1985). At the same time, they learn stereotypes of men that portray men as aggressive, smart, strong, active, self-confident, blunt, and analytical (Archer 1985).

Early adolescence is the time when many girls first become conscious that they are growing up in a society that often values traditional female roles. According to Fiebert (1990), the traditional female role includes four dimensions: women's interest in appearance and beauty, women's interest in domestic skills, women's concern for the care and nurture of others, and women's preoccupation with romance. Traditional female roles often are reinforced by socializing agents at home, in schools, and in popular culture that convey social expectations for women with regard to their physical appearance and body images, personal relationships, sexuality, and professional roles (see, e.g., Mazzarella and Pecora 1999).

The social environments in which girls are raised, however, vary considerably, and girls' unique identities are also influenced by their experiences related to race, culture, social class, sexual identity, and disability (Erkut et al. 1996, 1999; Phillips 1998). However, while not all adolescent girls share

exactly the same experiences growing up as girls, they do share in the experience of growing up as girls in a society that assigns roles on the basis of gender. According to *The Girls Report: What We Know and Need to Know about Growing Up Female* (Phillips 1998), published by the National Council for Research on Women,

> Many girls face enormous pressure to judge their self-worth based on narrow standards of physical attractiveness; to put boys and men ahead of themselves; and to conform to very narrow notions of femininity which promote passivity, compliance, and self-sacrifice, while discouraging strength, autonomy, and entitlement to pursue one's own desire. (Pp. 10-11)

As adolescent girls consider an array of "possible selves" (Ruvolo and Markus 1992, 95) during identity formation, their conceptions of gender play a critical role. One's gender- or sex-role identity is defined as "the selection and internalization of personally expressive values, beliefs, and goals perceived as appropriate to one's gender" (Archer 1985, 80). Growing up in gender-polarized social environments, girls learn socially derived scripts for women and men that assign women and men to specific and often separate roles that can limit the experiences of women and opportunities for women (Bem 1994). When adolescent girls define themselves by gender, they create identities that mirror the "different and unequal roles assigned to them in an androcentric and gender-polarized social world" (Bem 1994, B3). Many adolescent girls are influenced by these social expectations of gender because they are so concerned about being popular (American Association of University Women 1998, 2000; Erkut et al. 1999; Orenstein 1994).

Gender Schema Theory: Learning about Gender and Gender Roles

During early childhood, long before the onset of adolescence, a number of socializing agents encourage children to accept gender-specific tasks and activities, patterns of communication, forms of social interaction, personality traits, and roles (Bem 1981; Liben and Signorella 1993). Gender schema theory (Bem 1981) describes how young children learn and internalize information about gender roles. The information young children learn about gender comes from various socializing agents in their lives. Children use this information to develop extensive networks of knowledge about gender (Bem 1981). These networks are called gender schemas (Bem 1981), the "cognitive structures stored in memory that organize gender-related knowledge, beliefs, attitudes, and preferences" (Liben and Signorella 1993, 141).

Gender schemas, just like other schemas people create and store in memory, are mental scripts (Schank and Abelson 1977) that help children

understand experiences in their lives and make decisions about how to behave in various situations. Just as children develop schemas about everyday routines and experiences, they also develop schemas about gender and gender roles. Once children are exposed to cultural definitions of gender and have developed related gender schemas, they start to apply them to situations and experiences they encounter in their everyday lives (Bem 1993). As children learn cultural definitions of gender, they store this information in memory and call upon it whenever they encounter new information related to gender (Bem 1993).

Gender schemas are important for the development of children's gender identities; however, they also are the source of gender stereotypes that lead to gender-stereotyped behavior (Levy and Carter 1989; Nihlen and Bailey 1988). Research shows that gender-role stereotypes are pervasive and can influence children's perceptions, beliefs, and behavior (Bem 1993). Studies show that children learn about gender roles, along with gender stereotypes, at a very young age. Children as young as two years old begin to label people by gender, show preferences for sex-typed toys, become aware of adult gender roles, and develop gender identities (Carter and Levy 1988; Weinraub et al. 1984). Four-year-old children who appear to have more gender-related knowledge are more likely to label people by gender (Hort, Leinbach, and Fagot 1991). Observations of preschool-aged girls reveal that young girls conform to adult feminine behavior when playing (Edelbrock and Sugawara 1978).

Young children tend to have especially rigid and limited perspectives of gender roles and to hold on to traditional views of gender that they have learned. In fact, preschool- and early elementary school–aged children more accurately remember information that matches the gender roles they have learned, and early elementary school–aged children will even alter information that is inconsistent with the gender roles they have learned (Carter and Levy 1988). Although children acquire more complex knowledge about gender as they mature, they still show a tendency to categorize other people and make distinctions on the basis of gender (Ruble and Stangor 1986).

The extent of influence of gender schemas on children's perceptions and behavior and the development of gender-role stereotypes in children varies. Gender schemas appear to have a greater influence on some children than on others (Carter and Levy 1988), and children differ in their tendencies to use gender schemas to process information and to make personal choices (Bem 1981; Serbin and Sprafkin 1986). The amount of attention a child pays to stereotypes, in general, varies depending on his or her current mood, immediate goals, generalized beliefs, and other factors (Hamilton, Sherman, and Ruvolo 1990). Overall, girls tend to show more gender stereotyping than

boys (Signorella, Bigler, and Liben 1993). Research has shown that preschoolers with less rigid perceptions of social norms are less likely to select gender-typed toys (Lobel and Menashri 1993), but older children in classrooms in which teachers differentiate by gender are more likely to exhibit gender stereotyping (Bigler 1995). Other research reveals that elementary school–aged children, who are less advanced developmentally and have less advanced classification skills, show signs of more gender stereotyping than those with more advanced skills (Bigler 1995).

Social Learning Theory: Learning Gender Stereotypes from the Media

Children may learn gender stereotypes from media sources that in turn may influence their attitudes and behaviors. Social learning theory (later called social cognitive theory; Bandura 1986) explains how children learn specific attitudes and behaviors from the images and characters they encounter in the media. According to this theory, children learn cultural patterns of behavior through repeated observations of both actual models in their social environments, such as parents and teachers, and symbolic models in their social environments, such as those depicted in the media (Bandura 1969). This theory describes how children learn to imitate the behavior of others in their environments through a process known as "identificatory learning" (Bandura, Ross, and Ross 1963a, 533).

Studies have documented the influence of media models on children's perceptions and behavior, including some early studies dating back to the 1950s and 1960s that first looked at the social effects of media content and the ways children learned behavior by modeling the actions of the characters seen on television and in films. These studies found that preschool-aged children were most likely to imitate models that appeared to have more power, children's imitation of media models was selective, children did not necessarily imitate all the behavior they saw, and children's behavior often represented a combination of elements from different models (Bandura, Ross, and Ross 1963a, 1963b). Another study, from the 1950s, showed that people identified with film characters that were of the same sex and tended to remember more accurately the actions and words of the characters with whom they identified (Maccoby and Wilson 1957). Another study revealed that viewers paid the most attention to characters they perceived to be the most important; for women, those were the female characters or heroines, and for men, those were the male characters or heroes (Maccoby and Wilson 1957). Women also were more likely than men to remember heroines' actions in romantic scenes (Maccoby and Wilson 1957).

More recent research on identificatory learning from the media explains that the extent of identification with media models is dependent on a variety of context- and viewer-specific variables that occur while using media. Research on television viewing (Comstock and Scharrer 2001) shows that the extent of media influence varies depending on a range of variables, including household attributes (socioeconomic status and norms about television use), individual attributes (mental ability, comprehension, and affinity for viewing), and situational influences (the presence of others, the time of viewing, and emotional state during viewing). Events that are simple, distinct, repeated, and realistic (typical of events found on television) are likely to be attended to by viewers, particularly when they are salient to viewers (Bandura 1986). Other studies describe the effects of "vicarious contact" with television characters on viewers' perceptions and stereotyping of groups when direct contact with people from these groups is limited (Fujioka 1999; Tan, Fujioka, and Lucht 1997).

In describing adolescents' responses to the images they see on television, researchers have highlighted four factors that influence how teens learn about life issues from television portrayals (Faber, Brown, and McLeod 1979). These four factors are (1) a viewer's perceptions of the salience of an issue, (2) the personal experience a viewer has had with persons in the occupation also held by the media model, (3) a viewer's ability to comprehend and interpret the behavior of media models, and (4) the cumulative impact of other socialization agents in a viewer's social and cultural environment (Faber, Brown, and McLeod 1979). Media content that addresses the specific "life tasks" or issues faced by teens is most likely to catch their attention and have the greatest impact on their knowledge, values, and behaviors (Faber, Brown, and McLeod 1979). The life tasks identified as being of greatest concerns for teens are (1) selecting an occupation and other future life roles, (2) learning how to interact with members of the opposite sex, (3) developing a sex-role identity, and (4) achieving independence from parents (Faber, Brown, and McLeod 1979).

Gender-Stereotyped Perceptions of SET Occupations

Numerous studies over the years have reported children's gender-stereotyped perceptions of science and engineering as masculine careers (Andre et al. 1999; Barman 1997; Chambers 1983; Farmer et al. 1998; Fort and Varney 1989; Jacobowitz 1983; Kahle 1989; Maoldomhnaigh and Hunt 1988; Matthews 1996; Mead and Metraux 1957; Newton and Newton 1998; Rosenthal 1993; Song and Kim 1999). Research shows that gender-role stereotypes restrict the professional aspirations of girls and young women,

causing them to avoid high-status careers in mathematics and science (Lupaschuk and Yewchuk 1998). For example, one study found that eleven-year-old girls who identified themselves as feminine were more likely to view science as a masculine profession, and those who view science as a profession more suitable for men are less willing to learn about science (Kelly and Smail 1986). Another study reported that high school–aged girls were more likely to avoid science and engineering careers because they see the extended years of education needed for higher prestige occupations in the sciences as competing with getting married and having children (Farmer et al. 1998).

When girls are exposed to cultural representations that show science and engineering as masculine domains, they may develop gender schemas that lead them to label these occupations as masculine. Studies have shown that many girls do indeed hold a "masculine image of science" (Kelly 1978, 112) and often think of engineers and scientists as being male (Baker and Leary 1995; Maoldomhnaigh and Hunt 1988). When girls label SET careers as masculine, they also automatically exclude themselves from educational and professional opportunities in these areas (Lee 1998). Research shows that preschool- and elementary school–aged girls expressed happiness when asked about having a traditionally feminine or "gender-role-consistent" future occupation and sadness and disgust over having a traditionally masculine or "gender-role-inconsistent" (Levy, Sadovsky, and Troseth 2000, 998) future occupation. Thus, analyses of cultural representations of science and engineering, specifically analyses of the portrayals of female scientists and engineers in the media, are important for advancing our understanding of the gender schemas that serve as potential sources of influence during a particularly impressionable time in the lives of adolescent girls.

Method

Selection of Films

To locate recent popular films that featured male and female scientists and engineers as primary characters, the following movie databases were searched for films released from 1991 to 2001: the *Reader's Guide to Periodical Literature*, Microsoft Word's *Cinemania* CD-ROM, *Movie Box Office Reports* (Movie Box Office 2001), and the Internet Movie Database (IMDb; Internet Movie Database 2001). To ensure as complete a list of films as possible, several databases were searched, and different combinations of keywords were used on the basis of which keywords produced the most

comprehensive lists of search results. To identify movies featuring scientists released from 1991 to 1997 from the *Reader's Guide to Periodical Literature*, the following key words were used: *movie and scientist*, *film and scientist*, *movie and woman scientist*, *film and woman scientist*, *movie and physicist*, *movie and space scientist*, *movie and biologist*, *movie and chemist*, *movie and geologist*, and *movie and researcher*. To identify movies featuring scientists released from 1991 to 2001 from the *Cinemania* CD-ROM, the following key words were used: *scientists*, *woman scientist*, *physicist*, *space scientist*, *biologist*, *chemist*, *geologist*, and *researcher*. Searches were limited to the following genres as listed in *Cinemania*: action, adventure, biography, children's, comedy, crime, disaster, drama, horror, mystery, political, prison, religious, romance, science fiction, sports, spy, thriller, war, and western. To identify films featuring scientists released from 1998 to 2001 from *Movie Box Office Reports* and the IMDb, a keyword search using the words *scientist* and *engineer* was used. For the search results from the IMDb, the film titles, plot summaries, and character lists for each movie were read to find mentions of characters who were scientists and engineers.

A master list was created after removing duplicate listings of movies. Several of the films initially identified as featuring scientists and engineers as characters but that did not actually feature such characters as determined by reading plot summaries and character lists on the IMDb were eliminated from the study. Foreign-language films that appeared on the list also were eliminated from the study. Seventy-four films were identified as featuring scientists and engineers as primary characters (see Appendix A).

Textual Analysis

The plot summaries and character lists of the films were reviewed to identify films that featured scientists and engineers as primary characters. Primary characters were defined as those who appeared as protagonists in central roles in the films and were shown regularly throughout the film. Scientist and engineer characters were defined as those who held professional positions in a variety of science and engineering disciplines, including the social sciences.

The character lists of these films then were reviewed to identify films that featured female scientists and engineers as primary characters. Female scientist and engineer characters were identified by looking for the names of female characters and female actors in the character lists of the films. Of the seventy-four films identified as featuring scientists and engineers as primary characters, twenty-five featured female scientists and engineers as primary characters (see Appendix A). Two of the twenty-five films (*Poison* 1991;

Mindwalk 1991) were not included in the textual analysis because they were no longer available in video stores (see Appendix B for final list).

The genre of each of the films identified as featuring female scientists and engineers as primary characters ($n = 23$) was noted on the basis of the genre classification listed in the film's entry on the IMDb. Each film was assigned to one of the following five categories on the basis of its listing in the IMDb: action or adventure, comedy, drama, science fiction, and horror. The first genre listed was used when films were assigned multiple genre classifications on the IMDb.

The textual analysis of the twenty-three films focused on the portrayals of female scientists and engineers shown as primary characters in the films. The textual analysis was conducted on the basis of guidelines established by Miles and Huberman (1994). First, the presence of each code was noted, and then recurring patterns were identified for each code. The codes address the following five themes: appearance; characterization; expertise, ability, and authority; work versus romance; and work and family life balance. I selected these codes as a framework for analyzing the images and text on the basis of previous research on images of female scientists and engineers in the mass media (Steinke 1997, 1998, 1999, 2004; Steinke and Long 1996). The recurring patterns identified for each code are discussed in the presentation of findings of the textual analysis presented in the next section.

Textual Analysis of Popular Films Featuring Female Scientists and Engineers

Film Genre and Ratings

Most of the films identified as featuring female scientists and engineers as primary characters were action or adventure or comedy films. The distribution for the twenty-three films among the five different genre classifications was as follows: nine films were classified as action or adventure films, six as comedies, three as dramas, three as horror films, and two as science fiction films (see Table 1).

The majority of films were rated PG-13, with a few rated PG or R. These ratings were determined from listings in the IMDb.

Appearance

Four recurring depictions relating to the appearance of the female scientist and engineer primary characters were noted in the films. Most of the female

TABLE 1
Number of Films Featuring Women Scientist and Engineer Primary Characters by Genre

Action and Adventure	*Comedy*	*Drama*	*Horror*	*Science Fiction*	*Total*
9	6	3	3	2	23

TABLE 2
Appearance of Female Scientist and Engineer Primary Characters by Genre

Appearance	*Action and Adventure*	*Comedy*	*Drama*	*Horror*	*Science Fiction*	*Total*
Attractive	8	2	3	3	2	18
Unattractive	0	0	0	0	0	0
Unattractive to attractive, sexy, and/or glamorous	1	2	0	0	0	3
Sexy and glamorous	1	1	0	0	0	2

scientist and engineer primary characters were depicted as attractive; unattractive; unattractive transformed to attractive, sexy, and/or glamorous; or sexy and glamorous (see Table 2).

In the twenty-three films analyzed, eighteen of the female scientist and engineer primary characters were depicted as attractive. In fact, the roles of many of the female scientist and engineer primary characters were performed by attractive and popular Hollywood female actors such as Julianne Moore (Dr. Sarah Harding in *The Lost World: Jurassic Park*), Laura Dern (Dr. Ellie Sattler in *Jurassic Park*), Janet Jackson (Professor Denise Gaines in *Nutty Professor II: The Klumps*), Sharon Stone (Dr. Elizabeth "Beth" Halperin in *Sphere*), Helen Hunt (Dr. JoAnne "Jo" Thorton-Harding in *Twister*), Jodie Foster (Dr. Eleanor "Ellie" Arroway in *Contact*), Elizabeth Shue (Dr. Emma Russell in *The Saint* and Researcher Linda McKay in *Hollow Man*), and Anne Heche (Dr. Amy Barnes in *Volcano*).

In the depictions of female scientist and engineer primary characters shown as attractive, the women generally were physically fit, wore stylish clothes or attire that would be considered appropriate for their professions, and wore their hair in contemporary and fashionable styles. For example, Professor Denise Gaines in *Nutty Professor II: The Klumps* wears a blazer and blouse as she uses a laser pointer to highlight molecular structures

projected on the screen in the front of a classroom. Dr. Emma Russell in *The Saint* wears a shirt and skirt and is mistaken for an audience member at a scientific lecture until she is called on as the main speaker. Many of the films that show female scientists conducting research out in the field present women who are dressed in attire appropriate for the work they do. Dr. Ellie Sattler in *Jurassic Park*, for example, is shown wearing jeans, denim shirts, and hiking boots, with her long hair pulled back. Many of the female astronauts, such as Dr. Elizabeth "Beth" Halperin in *Sphere*, Julie Ford in *Rocket Man*, and Commander Kate Bowman in *Red Planet*, appear in T-shirts, sweats, flight suits, or space gear, just like their male colleagues.

None of the female scientist and engineer primary characters in these films were depicted as unattractive throughout the entire film. However, a few of the female scientist and engineer primary characters were transformed from unattractive or plain-looking women to attractive or sexy and glamorous women. These characters include Dr. Diana Reddin (Emma Thompson) in *Junior*, Dr. Diane Farrow (Sandra Bullock) in *Love Potion No. 9*, and Pamela Isley/Poison Ivy (Uma Thurman) in *Batman and Robin*.

Dr. Diana Reddin is often shown in the film *Junior* wearing a long gray lab coat, a drab brown sweater vest, a beige blouse, and plain gray pants, with her hair pulled back in a ponytail. Later in the film, Reddin appears at a social function wearing a fitted, short black dress and black high-heeled pumps, with her hair hanging down at her shoulders in curls. Her transformation in appearance is a sharp contrast to her usual plain appearance and unstylish wardrobe.

The depiction of Dr. Diane Farrow at the beginning of the film *Love Potion No. 9* exaggerates her unattractive appearance. While Reddin is depicted as plain and homely, Farrow is depicted as nerdy and homely. Farrow first appears wearing a baggy blue sweater, a white blouse buttoned all the way up to the top button, and large black-rimmed glasses. Her unattractiveness is further emphasized by her wavy, unkempt black hair, which is loosely pulled back in a messy ponytail. She wears outdated clothes compared with the group of stylishly dressed, attractive young women with whom she is having lunch when she is first seen in the film. After drinking a love potion, however, Farrow's physical appearance is magically transformed from unattractive to attractive, and she becomes even more glamorous and dresses even more provocatively. When she is later shown at a party, her teeth have been straightened and her hair swept up, and she is dressed in high heels and a tight-fitting black evening gown.

Like Farrow, botanist Pamela Isley in *Batman and Robin* initially is depicted as ugly and unstylish. Unlike Farrow, however, Isley's appearance focuses on the madness of her character. Isley is first shown in her small

laboratory wearing a laboratory coat; oversized rubber gloves; a mossy green apron; and thick, dark-rimmed eyeglasses, with her unkempt hair piled on top of her head and loosely pinned under a turban. Isley has a wild look about her as she glances furtively from under her glasses. However, like Farrow's, Isley's appearance also changes from unattractive to sexy and glamorous. When chemicals from Isley's lab spill on her during a fight with a male scientist, she is transformed into Poison Ivy, whose sexy and glamorous appearance is the complete opposite of Isley's wild and crazy appearance. Poison Ivy is shown wearing a sleek, skin-tight, green pantsuit, with long hair dyed bright red, green eye makeup, and bright red lipstick.

Many of the depictions of female scientist and engineer primary characters in the films showed them as attractive or as transformed from unattractive to attractive or sexy and glamorous. However, only two depictions of female scientist and engineer characters focused on the sexiness and glamour of the characters' appearances throughout the films. In *The Mummy Returns*, archeologist Evelyn "Evie" Carnahan's beauty is emphasized at the very beginning and throughout the film by her attire and overall appearance. Carnahan is first seen wearing a tight-fitting, low-cut tank top; a tight-fitting sweater hanging off one of her shoulders; stylish black boots; and bold, modern jewelry. Her black hair hangs in thick curls below her shoulders as she and her husband work on an archeological dig. Unlike the depictions of other female archeologists and other female scientists, who wear attire that appears to be more appropriate for conducting fieldwork, depictions of Evie show her dressed in stylish clothing that would not be practical for the fieldwork she does. Her attire is more appropriate for an evening out than the scientific work she is doing.

In *Evolution*, Dr. Allison Reed, a deputy director with the Centers for Disease Control and Prevention, has been sent to a research facility in the middle of the Arizona desert to investigate alien organisms that evolved from a meteor that struck Earth. She is shown wearing attire that at first glance appears professional and appropriate: a blouse, a skirt, and an overcoat. Reed trips over a step, and the male scientists standing next to Reed notice that she is wearing a garter belt under her skirt. In another scene, Reed appears in court wearing a green silk blouse that is noticeably tight and low.

Characterization

Four recurring depictions related to the characterization of the female scientist and engineer primary characters were noted in the twenty-three films. Across all genres, most of the female scientist and engineer primary characters were depicted as professional and realistic. Few of the female scientist

TABLE 3
Characterization of Female Scientist and Engineer Primary Characters by Genre

Characterization	*Action and Adventure*	*Comedy*	*Drama*	*Horror*	*Science Fiction*	*Total*
Professional and realistic	9	2	3	3	1	18
Mad and maniacal	1	0	0	0	1	2
Clumsy and absentminded	0	2	0	0	0	2
Nerdy and antisocial	0	1	0	0	0	1

and engineer primary characters were depicted as mad and maniacal, clumsy and absentminded, or nerdy and antisocial (see Table 3).

The predominant portrayal of female scientists and engineers showed realistic representations of these women as professionals. This portrayal was noted for characters working in a variety of scientific and engineering disciplines, such as geologist Amy Barnes in *Volcano*, NASA engineer Sara Holland in *Space Cowboys*, molecular biologist Denise Gaines in *Nutty Professor II: The Klumps*, microbiologist Laura Baker in *Species*, paleontologist Ellie Sattler in *Jurassic Park*, and geologist Allison Reed in *Evolution*. The female scientist and engineer primary characters in films that portrayed them as professionals were depicted as knowledgeable, articulate, outspoken, driven, confident, competent, creative, and independent. Most of the female scientist and engineer primary characters presented themselves as hardworking professionals, exhibited a strong passion for their work, and showed relentless determination even when faced with adversity.

As mentioned, few portrayals of female scientist primary characters in the films reinforced popular stereotypes of scientists as mad and maniacal, clumsy and absentminded, or nerdy and antisocial. The most poignant example of a female scientist as mad and maniacal appears in *Batman and Robin*. Dr. Pamela Isley's unruly and unkempt appearance and furtive behavior suggest the look and actions of a mad scientist. While she works among racks of flasks and glassware in a dark, castlelike cave, she is interrupted frequently by screams that come from the locked, nearby lab of a male colleague. Even her description of her scientific research is obscure, strange, and a bit misdirected:

> Drats, my experiment to mate the Dendronium orchid with the South American rattlesnake have failed again. But I still have high hopes for the animal/plant cross-breedings. If I can only find the correct dose of venom, these plants

> will be able to fight back like animals. I will have given flora a chance against the thoughtless ravages of man.

The character of Dr. Elizabeth "Beth" Halperin in *Sphere* is another example of a female scientist who is depicted as mad. However, Halperin's characterization is quite different from Poison Ivy's. She is not shown as an evil, maniacal, mad scientist like Poison Ivy but rather an emotionally and psychologically unstable scientist. While Poison Ivy's characterization is intended to be funny and unrealistic, Halperin's character is serious and realistic. When one of the male scientists aboard an underwater research station discusses Halperin's mental history and her suicide attempt, he says, "Now we've got a nut bag down here who can flip down and crack up."

Although much less frequent than depictions of female scientist and engineer primary characters as realistic and professional, a couple of the depictions of female primary characters showed them as clumsy and absentminded. One female scientist primary character who is shown as extremely clumsy and absentminded appears in the film *Junior.* Dr. Diana Reddin is first seen outside her new lab fussing over the incubator that houses human eggs for her ovum cryogenics project and telling the movers that they have to be extremely careful with the incubator. She hits a lever by accident that sends the incubator flying down a ramp into her new lab. She jumps on top of the incubator in an attempt to protect the eggs, and she literally lands on top of Dr. Alex Hesse, a male scientist who has just been displaced from the lab after a failed attempt to receive U.S. Food and Drug Administration funding. Several other scenes throughout the film emphasize Reddin's absentmindedness and clumsiness. For example, in one scene in which she is shown having fallen asleep at the computer while working late, she laughs about the piece of cheese from her sandwich that is stuck to her face. In another scene, when she is dancing at a social function, Reddin kicks off her right shoe while trying to shake off a piece of toilet paper stuck to its bottom. Later in the film, when she is interrupted while kissing Hesse, Reddin falls over backward, knocking over the sofa as she falls.

Another comedy, *Evolution*, focused on the clumsiness and absentmindedness of the female scientist primary character. Throughout this film, Dr. Allison Reed, a deputy director for the Centers for Disease Control and Prevention, is shown tripping, falling, bumping into a closed door, fumbling while closing a car door, and dropping file folders. Unlike Reddin, who is depicted as plain and homely in addition to being clumsy and absentminded, Reed is depicted as more alluring in appearance but still clumsy and absentminded.

Another comedy presented a female scientist primary character as nerdy and antisocial. In *Love Potion No. 9*, Diane Farrow is initially presented as an

TABLE 4
Professional Status of Female Scientist and Engineer Primary Characters by Genre

Professional Status	*Action and Adventure*	*Comedy*	*Drama*	*Horror*	*Science Fiction*	*Total*
Project or research director	5	3	2	0	1	11
Laboratory or research assistant	1	0	0	0	0	1
Equal member of a research team	2	2	1	3	1	9
Administrator	1	1	0	0	0	2

unattractive loner who is involved in an unfulfilling romantic relationship. The young physiobiologist works in a corporate-owned primate research facility, and she comes home alone at night to an impeccably clean and organized apartment and an answering machine with no messages.

Professional Status: Expertise, Ability, and Authority

One indicator of the expertise, ability, and authority of the female scientist and engineer primary characters in the films was their professional status. In general, female scientist and engineer primary characters across genres were shown as having one of the following professional positions: project or research director, laboratory or research assistant, equal member of a research team, or administrator (see Table 4).

Many of these portrayals showed female scientists and engineers working as principal investigators and project directors, while others showed female scientists and engineers as equal contributors on various scientific research projects, typically working with male colleagues as equals or as equal members of a research team. It is interesting to note that none of the films showed more than one female scientist or engineer as part of a research team, but several of the films showed two or more male scientists or engineers as part of a research team.

Most of the female primary characters were shown as project or research directors ($n = 11$) or as equal members of a research team ($n = 9$). Many of these characters, across most film genres and particularly in action and adventure films, were featured as the scientists primarily responsible for research projects. Examples of these characters include Dr. JoAnne "Jo" Thorton-Harding in *Twister*, Dr. Amy Barnes in *Volcano*, Dr. Paula Olsen in

Nell, Dr. Diana Reddin in *Junior*, Dr. Pamela Isley in *Batman and Robin*, Dr. Eve Simmons in *Eve of Destruction*, and Dr. Emma Russell in *The Saint*. Many other female scientist and engineer primary characters across all genres were presented as equal members of a research team, such as Julie Ford in *Rocket Man*, Dr. Elena Kinder in *Baby Geniuses*, Dr. Sarah Harding in *The Lost World: Jurassic Park*, and Dr. Laura Baker in *Species*.

Many of these depictions of women scientist and engineer primary characters showed these women in charge of research projects and directing staffs of research assistants. The depiction of Dr. Eleanor "Ellie" Arroway in *Contact* focuses on her role as a research director. Ellie leads the Search for Extraterrestrial Intelligence project, assisted by her collaborator, Kent Clark, and two research assistants, Fisher and Willie. Although Ellie collaborates with Kent Clark from time to time, she is clearly in charge of the project. Throughout the film, Ellie is frequently shown directing the work of others in the laboratory and conducting much of the research herself, either in the laboratory or in the field. She is the driving force behind the project, the person who keeps the project going when research funding is cut.

Dr. Eve Simmons, a young robotics engineer, is portrayed as the principal investigator "in charge" of an entire project in *Eve of Destruction*, a science fiction film from 1991. Dr. Eve Simmons directs a government-sponsored project to create a humanlike robot modeled after Simmons and called Eve. In one of the first scenes in which Simmons appears, she is shown overseeing a test of a male robot. Simmons directs the testing with help from a female research assistant, two male research assistants, and a male colleague.

In *Love Potion No. 9*, Diane Farrow also is clearly in charge of her own research program and laboratory. In one scene, she is seen inside a corporate-owned primate research laboratory seated in front of two chimpanzees, assessing their reactions to the pictures she holds. A male colleague comes to get Farrow's permission before he administers a chemical compound he has been analyzing. In the scenes in which she is describing the experiments she has conducted, Farrow gives specific and clear details without hesitation, and in other scenes, she clearly and confidently explains scientific concepts and phenomena related to her research.

In the films in which female scientist and engineer primary characters were shown as project directors, the female project directors often are questioned or challenged many times by male colleagues or peers. Also they find themselves explaining their credentials and professional experience, defending the value of their research projects or research ideas, and justifying the decisions they make about their research. In *Eve of Destruction*, for example, Eve Simmons is seen defending her position when a male colleague, Dr. Heller, questions her progress after she calls for a halt to the testing of the

robot, Lincoln. Heller asks Simmons how much further behind she is on the project. Simmons replies that she will not know until she has done a full analysis. Heller sarcastically remarks, "Try an educated guess." He is not satisfied with Simmons's tentative reply and reminds her that they have seven weeks before Lincoln is up for review. Simmons reminds Heller of the consequence of rushing the research, holds her ground, and firmly responds, "Need I remind you, Dr. Heller, that if that hand in there can't play piano without setting itself on fire, we'll be working at the corner auto shop rebuilding transmissions."

In *Contact*, Eleanor Arroway's unconventional approach to her research is often misinterpreted by other scientists, and her credibility is weakened by her unique ways of doing science. Yet she remains determined to finish the work she has started and says that if she has to, she will do the research by herself. Arroway encounters ridicule and skepticism from male colleagues during her attempts to find research funding. Yet she is relentless and spends thirteen months searching for funding before she succeeds. Even after her presentation at Hadden Enterprises, which ultimately funds her research, a committee member tells Arroway that her research proposal seems more like science fiction than science. Once again, Arroway defends the value of the work she is doing, pointing out that a lot of inventions of modern society would not have been created if someone had not thought unconventionally.

In some of the films that feature male professionals who are not engineers and scientists, these male professionals also downplay or question the expertise of female engineers and scientists. In *Volcano*, for example, geologist Amy Barnes has to defend her position when a male emergency management official criticizes the tentative nature of her assessments. She replies, "I'm a scientist. Certainty is a big word. I have to have time to collect my data. I've got to get down there and collect my samples." She later relates to her female colleague how this official doubts their ability to gather samples underground because they are women. She sarcastically mocks him and says, "Too dangerous. It's man's work and you're just little girlies. I can't let you go down there."

Depictions of female scientist and engineer primary characters working as equal members of research teams were almost as likely to be found in the film as were depictions of female scientist and engineer primary characters working as principal researchers or project directors. Many of the female scientists and engineers were shown as members of research teams or paired with male colleagues. For example, geologist Evelyn O'Connell sets off on archeological digs and adventures with her husband and colleague, geologist Richard O'Connell. Dr. Allison Reed eventually teams up with two other

male colleagues in *Evolution* to figure out how to stop the evolution of alien creatures.

In most of the films that showed female scientists and engineers as equal members of research teams, the comments and suggestions made by these women were usually respected and heeded by male colleagues. For example, in *Species*, molecular biologist Laura Baker suggests the next step: "Couldn't we try growing this creature with just its own DNA? We make a version without including ours this time, so we can investigate its vulnerability." Her male colleagues agree that her suggestion makes sense and proceed with the experiment. Similarly, the opinions of Dr. Elena Kinder in *Baby Geniuses* are respected by her male colleague, Dr. Heep. Kinder and Heep are working on a research project to test the superiority of Kinder's method on a select group of babies in their research facility. Although Kinder plays a more dominant role in the movie and provides the financial support for the research, both appear to be equally involved in the research project. Both Kinder and Heep observe the babies and discuss the data on brain development together.

In some of the films that featured female scientist and engineer primary characters as equal members of research teams, just like the films that featured female scientist and engineer primary characters as principal investigators or project directors, female scientist and engineer primary characters were questioned or challenged by male colleagues or peers. These women often found themselves having to explain their credentials and professional experience, defend the value of their research projects or research ideas, and justify their decisions about their research.

Although Dr. Rae Crane in *Medicine Man* is an established research scientist with a strong reputation, she continuously has to defend her position with her male colleague, Dr. Robert Campbell. In the beginning of the film, Campbell tells Crane to go home when she first arrives, questions the extent of Crane's field experience, and orders her around when she is working in the lab. He makes a sexist remark by calling her a "hussy" and condescendingly complains when she arrives, "They sent a girl?" However, Crane defends herself and recites her credentials:

> I'm published, and more extensively than Dr. Sealove. I hold degrees from CCNY, Berkeley and Cambridge. I'm the recipient of the Thurman Award in '82 and '86, the first and only time it's ever been given to the same person twice.

Campbell looks unimpressed. In *Medicine Man*, Crane frequently reminds Campbell that she is not his research assistant. She says, "I'm not a 19-year-old working up a resume. And I don't expect to be treated as if I were."

In *Batman and Robin*, although botanist Pamela Isley works independently on a project, the male scientist who works in the lab next to hers tries to persuade her to work on his research and steals her research samples to benefit his own research.

Only two films showed female scientist or engineer primary characters as administrators. Dr. Allison Reed in *Evolution* is presented as a deputy director for the Centers for Disease Control and Prevention, and Dr. Sara Holland in *Space Cowboys* is depicted as a NASA administrator. Like the portrayals of female scientists and engineers in other professional positions, the portrayals of these women also show them having to defend themselves and their expertise. In *Evolution*, a male scientist wrongly accuses Reed of stealing samples and computer files, and male colleagues frequently interrupt and ignore Reed. In *Space Cowboys*, a male administrator insults Holland by telling her that she may be knowledgeable about science, but she knows nothing about politics. Later in the film, she tells him that he may be knowledgeable about politics, but he knows nothing about science.

The depictions of some female scientist and engineer primary characters show them facing more than just questions and challenges from male colleagues. A few of these female scientists and engineers also deal with colleagues who take away research funding or laboratory space, take credit for their scientific accomplishments, or speak on their behalf. In *Batman and Robin*, Isley also notes her exclusion from her male colleague's research facility and research projects. As she records her notes about her own project, she says, "Personal note: my work would proceed faster if Dr. Woodrue weren't always whisking my venom samples back to his mysterious Gilgamesh wing. Why won't he let me into his lab? What is he doing in there?" When Woodrue later explains that he is out of research funding and asks Isely to join him "side by side," she replies,

> Join you? I have spent my life trying to protect plants from extinction and now you corrupt my research into some maniacal scheme for world domination. When I get through you won't be able to get a job teaching high school chemistry. Do you hear me? You psycho?

In *Space Cowboys*, Sara Holland speaks before a group of scientists and administrators during a NASA briefing to explain what has happened to a failing satellite, when a male colleague literally steps in front of her, interrupts her, addresses the audience himself, and takes over the meeting.

The depictions of some of the female scientists and engineers even show them as facing sexual harassment in the workplace. In *Evolution*, a male scientist makes crude remarks about Reed's physical appearance and calls her a

"humorless ice queen" in need of sexual attention. In *Batman and Robin*, Dr. Jason Woodrue, a male scientist working in the lab next to Dr. Pamela Isley, puts his arm around Isley and pulls her to him in a close embrace when he asks her to join him in his research. In *Hollow Man*, Linda McKay is unknowingly stalked by Sebastian Caine, her former lover and current coworker, who has become invisible. Caine becomes enraged with jealousy when he discovers that McKay is romantically involved with another male coworker, and he later violently grabs McKay and tries to force her to kiss him "for old times' sake." In *Red Planet*, Commander Kate Bowman becomes the target of sexist remarks when she joins her male colleagues and crew members for a drink. One of her crew members conjectures about what each of them could be on Mars. He turns to Bowman and says that she'll be his queen on Mars for the "propagation of the species." Bowman, the usually in-charge, no-nonsense, outspoken mission leader who volunteers for the risky work and fearlessly stands up to her all-male crew, often referring to them as boys, is speechless after hearing these words. Bowman glares at her colleague, gets up out of her seat, and leaves the cabin without a word.

Work versus Romance

Few depictions of female scientist and engineer primary characters in the selected films showed women who were not either currently or formerly involved in romantic relationships. In fact, twenty of the twenty-three films featured female scientist and engineer primary characters involved in romantic relationships (see Table 5).

Romance was a dominant theme in many of the films that featured female scientist and engineer primary characters. Many of the female scientists and engineers are romantically involved with other male scientists or engineers featured as primary characters in the films. Some of the female scientist and engineer primary characters fall in love with male scientists or engineers (Allison Reed in *Evolution*, Ellie Sattler in *Jurassic Park*, Diane Farrow in *Love Potion No. 9*, Rae Crane in *Medicine Man*, Kate Bowman in *Red Planet*, Julie Ford in *Rocket Man*, Sara Holland in *Space Cowboys*), and others fall in love with and eventually marry male scientists or engineers (Diana Reddin in *Junior*, Denise Gaines in *Nutty Professor II: The Klumps*). A few fall in love with male characters who are not scientists or engineers (Ellie Arroway in *Contact*, Emma Russell in *The Saint*, Laura Baker in *Species*, Amy Barnes in *Volcano*), and one falls in love with and eventually marries a male character who is not a scientist or engineer (Paula Olsen in *Nell*). Two are shown working with male colleagues with whom they have had romantic relationships in the past (Sarah Harding in *The Lost World: Jurassic Park*, Elizabeth Halperin

TABLE 5
Female Scientist and Engineer Primary Characters with Romantic Relationships by Genre

Action and Adventure	*Comedy*	*Drama*	*Horror*	*Science Fiction*	*Total*
7	5	3	3	2	20

in *Sphere*). One is shown married to another male scientist (Evelyn Carnahan O'Connell in *The Mummy Returns*). Another one is shown filing for divorce but considering reconciling with her scientist husband (Robby Keough in *Outbreak*), and another is shown stalling for more time in an attempt to win back a husband who was a scientist colleague and is now a weatherman and is filing for divorce (JoAnne Thorton-Harding in *Twister*).

In some films, female scientists and engineers fall in love with male colleagues or other male characters who initially questioned their expertise or ridiculed their ability, like psychiatrist Paula Olsen in *Nell*, biologist Diana Reddin in *Junior*, geologist Amy Barnes in *Volcano*, and botanist Rae Crane in *Medicine Man*.

One theme that emerges from the images and texts of films that portray female scientist and engineer primary characters who are involved in romantic relationships is the conflict between balancing one's professional life and personal life with regard to romantic relationships. When a romantic relationship intensifies between astronomer Ellie Arroway and Palmer Joss in *Contact*, Arroway abruptly leaves Joss one morning to go to work. She gathers her belongings, does not wake him, and leaves behind the phone number he put on the nightstand beside the bed. She appears embarrassed when they later meet in the film.

A few, although not many, films show female engineer and scientist primary characters falling in love with male colleagues later on in the films, only after important research projects or missions have been completed. For example, for Dr. Rae Crane in *Medicine Man* and Dr. Paula Olsen in *Nell*, romance develops only after their research projects have been completed. Dr. Paula Olsen, a social scientist in *Nell*, is completely focused on her career throughout most of the film. When she first learns of a child who grew up without human interaction from Jerry Lovell, a physician who discovered the child, she says that she wants to meet her right away. When she later meets Nell, Olsen devotes day and night to studying the child. Lovell chides Olsen for her intense focus on her scientific research and asks her, "Don't you have a life?" Olsen responds, "It can wait." As Olsen sets up her research station

near Nell's home, she emphatically states that her first priority is studying Nell. She sets up a video camera to observe Nell's behavior, records her observations and thoughts with a handheld tape recorder, makes notes about Nell's speech patterns, analyzes Nell's speech patterns, and gives Nell books to socialize her. At one time, Lovell criticizes Olsen for her single-minded attention to her research: "What would you know about happy couples?" Eventually, Olsen marries Lovell when she finishes her study of Nell.

Another theme related to the romantic relationships of the female characters in some of the other films emphasizes, at least initially in the films, the lack of romantic relationships for some female scientists. For example, biologist Diana Reddin in *Junior* secretly freezes her own eggs in her laboratory storage area until she is able to start a relationship with someone. Diane Farrow in *Love Potion No. 9* comes home to learn that she has no messages on her answering machine. Only after she drinks a magic potion and is transformed from ugly to glamorous does her social life improve and she discovers her true love for fellow scientist Paul Matthews.

Few depictions show female scientists and engineers sacrificing their professional careers for romance. One such depiction appears, however, in *Nutty Professor II: The Klumps*. Geneticist Denise Gaines explains to a male colleague, Sherman Klump, with whom she is in love, that she is thinking about passing up an offer for a full professorship at the University of Maine. When Klump tells her this is a good opportunity for her and she can continue the research that they have started when she is on her own at Maine, she says she is hesitant about this new professional opportunity because she does not want to leave him. Even when she makes her big announcement, she apologizes to Klump for keeping him from his research.

Work and Family Life Balance

Few films showed female scientist and engineer primary characters as working mothers. In fact, only four of the twenty-three films featured female scientists and engineers who were mothers (see Table 6).

Only two of these featured female scientists and engineers were full-time working mothers (*Eve of Destruction* and *The Mummy Returns*). The other two films showed female scientists who became mothers at the very end of the films (*Junior* and *Nell*). Most of the female scientists and engineers in the selected films were single, and if they were married or later married, most did not have children.

Archeologists Evelyn Carnahan O'Connell and Richard O'Connell in *The Mummy Returns* are the only dual-career scientist couple shown in the selected films sharing child care responsibilities for their young son

TABLE 6
Female Scientist and Engineer Primary Characters with Children by Genre

Action and Adventure	*Comedy*	*Drama*	*Horror*	*Science Fiction*	*Total*
2	1	1	0	0	4

Jonathan. When both parents are off on archeological digs, Jonathan follows along. Evelyn and Richard appear to be equal partners at both work and home.

One of the few portrayals of a full-time, working female scientist appears in *Eve of Destruction*. Simmons' role as mother receives little attention throughout the film. Her work as a robotics engineer goes uninterrupted during most of the film, and only near the end of the film is she shown with her young son, Tim. In this scene, Simmons frantically types at the computer, her eyes intently focused on the screen. Tim asks, "Mom, can we go over this?" When she replies, "One second, Tim," he walks over to her and shuts off the computer. Simmons smiles and laughs and goes over to look at Tim's coloring books. Simmons jokes with Tim, but soon, she is interrupted by a phone call. Simmons explains that she has to leave, hugs her son, and promises to take him to the aquarium some other time. Tim walks away slowly, looking down at the floor. Simmons, like many full-time working mothers, is shown attempting to balance work and child care. When her son despondently walks away, the message is clear: she has not done enough. Despite her reassurances of her love for her son and her promise to spend time with him later, he looks disappointed by her unexpected return to the working world.

Discussion

Images of female scientists and engineers presented in popular films are symbolic models that serve as sources of information about women, gender roles, and female scientists and engineers. As symbolic models, these images have the potential to shape adolescent girls' perceptions of gender roles and their own future roles, including their perceptions of scientists and engineers and their interest in scientific and engineering careers.

Historically, media content has been filled with images of women that reinforce social and cultural norms of femininity and traditional work roles for women. Although research has shown that media images of women (Signorelli 1997) and of female scientists and engineers (Steinke 1999,

2004) have improved over time, stereotypical images of women still are found in the mass media today. It is important to examine the assumptions about women reflected by these images, because the media are important socializing agents in the lives of adolescents (Faber, Brown, and McLeod 1979). Media images can influence adolescent girls' perceptions of women (Beuf 1974; Morgan 1982), their individual identities (Signorelli 1997), their "possible selves" (Ruvolo and Markus 1992, 95), and their visions of who they can become in the future (Ruvolo and Markus 1992). In light of this research on the potential influence of the media, two key questions guided the analysis of images in these films: (1) Do film depictions of female scientists and engineers emphasize their femininity and encourage conformity to traditional stereotypes of women? and (2) Do film depictions of female scientists and engineers reinforce traditional social and cultural assumptions of the role of women in SET?

The findings of this analysis suggest that the depictions of female scientists and engineers in these films often emphasized the femininity of the featured female scientists and engineers, but they did not necessarily, in all cases, urge conformity to traditional stereotypes of women. While many of the female scientists and engineers in these films were shown as attractive (many of these roles were performed by young, popular, and glamorous Hollywood actresses), and romance was a dominant theme in the films, the depictions were realistic and presented female scientists and engineers in professional positions of high status. The female scientists and engineers were rarely shown compromising their professional positions for romance. Previous research found that portrayals of female scientists often focused on their attractiveness and beauty and romantic relationships (Flicker 2003), but other research found few portrayals of women shown as research or project directors (Steinke and Long 1996). Most of the female scientists and engineers featured in these films, however, were shown in positions of high prestige, such as project directors or equal members of research teams, and were knowledgeable, articulate, outspoken, driven, confident, competent, creative, and independent, even when romance was a dominant theme.

Portrayals of female scientists and engineers that show women as realistic professionals in prestigious positions may provide adolescent girls with positive role models, even when these portrayals emphasize their appearance and focus on romance. It is possible that portrayals of female scientists and engineers that show them as attractive and emphasize romance may be more memorable and salient role models that allow for better identification. A study by Maccoby and Wilson (1957) found that people identified better with characters of the same sex and tended to remember better the words and actions of characters with whom they identified. Although images of female

scientists and engineers that focus on romance initially appear to detract from the serious professional work conducted by these characters, they may help adolescent girls better identify with the characters and their professional lives. An early study showed that women were more likely to remember heroines' actions in romantic scenes (Maccoby and Wilson 1957). Adolescent girls may be more likely to identify with female scientist and engineer characters and may be more likely to see themselves working as scientists and engineers in the future when images of female scientists and engineers catch their attention and are more salient to them.

The findings from this analysis also revealed depictions of female scientists and engineers that reinforced traditional social and cultural assumptions of the role of women in SET. Most of the female scientists and engineers in these films were single, and if they were married or later married in the films, most did not have children. Few films presented depictions of female scientist and engineer primary characters as working mothers.

The focus on female scientists and engineers as single and the lack of images of working mothers noted in this sample of films represents an important direction for future research. The impact, if any, of the message conveyed by some of the female scientist and engineer primary characters about the difficulties of balancing work and family and the scarcity of characters presented as successfully balancing work and family needs to be examined given recent research on women's perceptions of SET careers. Hanson (2000) writes, "A critical element in the culture of science occupations involves ideas about having to be wedded to one's work—making it difficult for women with families (spouses and/or children), but not men with families, to succeed" (p. 170). In fact, a study of male and female university students found that male students were more likely than female students to express concern over the challenges women face in balancing careers in science with marriage and motherhood, and both male and female students reported only a modest concern about women's abilities to combine careers in science and family responsibilities (Lips 1992). A study of the major challenges found by a group of female scientists and engineers reported that both groups of women ranked "balancing family responsibilities with work as the overwhelming difficulty" they faced in their careers (Rosser and Zieseniss 2000, 111).

Traditional social and cultural assumptions of the role of women in SET were noted in images that highlighted the female scientist and engineer primary characters' interactions with male colleagues. These interactions emphasized overt and subtle forms of stereotyping and discrimination in the male-dominated research environments in which they worked. Female scientists and engineers in professional positions of high prestige in some of these

films were questioned or challenged by male colleagues or peers, criticized for a lack of credentials and professional experience, experienced a loss of research funding or lab space when male supervisors failed to see value in their research, ridiculed and dismissed for taking unconventional approaches when doing science, pushed aside and silenced when providing explanations or justification for their actions, sexually harassed when perceived as a threat by male colleagues, and pushed away as male colleagues stepped forward to take credit for their discoveries and accomplishments. This overt and subtle stereotyping of female scientists and engineers found in many of the depictions of female scientists and engineers in these films threatens to undermine girls' identification with these images and their future interest in SET careers.

The precise influence, if any, of portrayals of female scientists and engineers in popular films such as those examined in this study on adolescents' perceptions of scientists and science is difficult to determine. Most of the films were assigned a rating of PG-13, with a few assigned a rating of PG or R, but it is difficult to know whether these films were popular among adolescents and what, if any, impact these images might have had. Future research needs to carefully examine images of female scientists and engineers, especially considering that the media have been shown to be important sources of information about future roles during the adolescent years. As preadolescent and adolescent girls start to think about future roles as they develop identities or senses of self, media images of women provide girls with representations of "possible selves" (Ruvolo and Markus 1992, 95) that help shape girls' perceptions of themselves and their future roles.

A better understanding of the cultural representations of gender, including media representations of gender, may be useful in enhancing efforts to encourage girls in SET. Studies such as these point to the need for research on the specific attributes of female scientist and engineer characters in the media that may be effective in serving as vicarious role models. Despite the tenacity of gender schemas, change is possible, and the mass media may be important agents of change. Media models may be important sources of information about scientists and engineers and careers in SET when direct contact with real-life role models is not possible. As symbolic models that are potential sources of information on gender roles, these images could be effective, positive role models that provide "vicarious contact" (Fujioka 1999; Tan, Fujioka, and Lucht 1997). More research is needed to examine the features of these media portrayals of female scientists and engineers that most appeal to girls and to determine which portrayals, if any, are most effective in changing girls' attitudes toward SET careers.

Media images of female scientists and engineers such as those examined in this study may be useful in developing media literacy programs to change

girls' perceptions of scientists and engineers and attitudes toward SET careers. Media intervention programs have been found to be effective in changing gender-role stereotypes. Research shows that girls from low socioeconomic backgrounds chose less traditional occupations after exposure to television portrayals of female characters in nontraditional occupations (Griffin, Sen, and Plotkin 1994), and girls rated traditionally male-dominated occupations more favorably after seeing televised female models in these occupations (O'Bryant and Corder-Bolz 1978). The pervasiveness of the media in children's lives and the critical shortage of qualified scientists and engineers in the workforce clearly underscore the need to examine the effectiveness of media literacy programs that teach children to recognize and evaluate critically the gender stereotypes that may be limiting future professional goals and aspirations in these areas.

Appendix A
Popular Films Featuring Scientist and Engineer Primary Characters, 1991 to 2001 (*N* = 74)

A.I.: Artificial Intelligence (2001)
Alien Resurrection (1997)
Armageddon (1999)
Asteroid (1998)
Avengers, The (1998)
Baby Geniuses (1999)*
Batman and Robin (1997)*
Blue Sky (1994)
Brief History of Time, A (1992)
Contact (1997)*
Dante's Peak (1997)
Deep Impact (1998)
Emperor of the Crystal Tower (Pokemon) (2001)
Eve of Destruction (1991)*
Evolution (2001)*
Extreme Measures (1996)
Fifth Element, The (1997)
Flubber (1997)
Forever Young (1992)
Guyver, The (1992)
Half Baked (1998)
Harry and the Hendersons (1987)
Highlander II: The Quickening (1991)

Hollow Man, The (2000)*
Honey, I Blew Up the Kids (1992)
Infinity (1996)
Inspector Gadget (1999)
Junior (1994)*
Jurassic Park (1993)*
Kafka (1991)
Kids in the Hall: Brain Candy (1996)
Killing Me Softly (2002)
Lawnmower Man, The (1992)
Lost World, The: Jurassic Park (1993)*
Love Potion No. 9 (1992)*
Making Mr. Right (1987)
Mary Shelley's Frankenstein (1994)
Medicine Man (1992)*
Mindwalk (1991)*
Mission to Mars (2000)
Mummy Returns, The (2001)*
My Favorite Martian (1999)
Mystery Science Theater 3000: The Movie (1996)
Nell (1994)*
Nutty Professor II: The Klumps (2000)*
Outbreak (1995)*
Place in the World, A (1997)
Poison (1991)*
Puppet Masters, The (1994)
Red Planet (2000)*
Rock, The (1996)
Rocketman (1997)*
Saint, The (1997)*
Shadow, The (1994)
Sixth Day, The (2000)
Someone Like You (2001)
Space Cowboys (2000)*
Species (1995)*
Sphere (1998)*
Star Trek: Generations (1994)
Stigmata (1999)
Street Fighter (1994)
Suburban Commando (1991)
Tarzan (1999)

Teenage Mutant Ninja Turtles II: The Secret of Ooze (1991)
Titan A.E. (2000)
Transatlantis (1995)
Twister (1996)*
Unforgettable (1996)
Vanishing, The (1993)
Volcano (1997)*
Waterboy, The (1998)
What Lies Beneath (2000)
Wild Wild West (1999)

NOTE: Films featuring female scientist and engineer primary characters are indicated with asterisks.

Appendix B
Popular Films Featuring Female Scientist and Engineer Primary Characters, 1991 to 2001 (*n* = 23)

Baby Geniuses (comedy, 1999, PG)
Batman and Robin (action and adventure, 1997, PG-13)
Contact (drama, 1997, PG)
Eve of Destruction (action and adventure, 1991, R)
Evolution (comedy, 2001, PG-13)
Hollow Man, The (horror, 2000, R)
Junior (comedy, 1994, PG-13)
Jurassic Park (horror, 1993, PG-13)
Lost World, The: Jurassic Park (horror, 1993, PG-13)
Love Potion No. 9 (comedy, 1992, PG-13)
Medicine Man (action and adventure, 1992, PG-13)
Mummy Returns, The (action and adventure, 2001, PG-13)
Nell (drama, 1994, PG-13)
Nutty Professor II: The Klumps (comedy, 2000, PG-13)
Outbreak (action and adventure, 1995, R)
Red Planet (science fiction, 2000, PG-13)
Rocket Man (comedy, 1997, PG)
Saint, The (action and adventure, 1997, PG-13)
Space Cowboys (action and adventure, 2000, PG-13)
Species (drama, 1995, R)
Sphere (science fiction, 1998, PG-13)
Twister (action and adventure, 1996, PG-13)
Volcano (action and adventure, 1997, PG-13)

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