



Bazinga! You're an engineer...you're___! A Qualitative Study on the Media and Perceptions of Engineers

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While a significant amount of television air time is dedicated to dramatizing careers, engineering careers seem somewhat vacant from the prime time line up. Many studies have been conducted to look at the impact of popular television shows on how people view career professionals but little has been done to look at the impact of popular media on people's views of engineers. This pilot study looked at the impact of viewing popular media articles that focus on engineering characters on a person's perception of an engineer. The study focused on using three popular media articles (*Dilbert*, *Mythbusters*, and *The Big Bang Theory*) as representations of engineers. Participants for this study were graduate students at a large research university. Utilizing individual interviews, participants in this study were asked to describe their initial mental picture of an engineer from their own personal experiences. Participants were shown a series of media articles and were asked to describe the mental picture of an engineer they held after watching the media articles. Finally, participants were asked to describe the similarities and differences between their original picture and the picture developed after watching the media articles.

Introduction

In American society today, exposure to the media is almost a certainty. Television, newspapers, magazines and the internet infiltrate American society every day. Professions such as law, medicine and public service have been represented in popular television shows such as *Ally McBeal*, *Law and Order*, *ER* and *NYPD Blue*, just to name a few. Researchers have documented the impact that these popular shows have on professional identity. For example, studies have been conducted to look at the impact of media representations on professional identity in the areas of law, medicine and public service¹⁻³. Although television shows and other media outlets (such as comic strips) display representations of scientists and engineers in plot lines, little research has been done with regard to impact that these representatives have on professional scientist and engineering identities. This study addresses that gap by examining how three popular media articles, *The Big Bang Theory*, *Dilbert*, and *Mythbusters*, portray science and engineering personalities. For the purpose of this paper, articles refer to mediums of entertainment, specifically comic strips and television shows. In *Changing the Conversation*, researchers found that many student participants still have a limited view on what engineers do⁴. With recent increases in representations of engineering and science related characters in mainstream television and newspapers, it is important that we consider the impact these characters may have on how people view the engineering profession.

This study examines the effect of the media in how people build a mental picture of engineers and engineering as a profession. It is important to look at how the media shapes people's pictures and perceptions of engineers because those pictures have the potential for building or sustaining a barrier deterring people from entering engineering fields. This study is

broadly situated in Social Identity Theory⁵ and then more narrowly focused using Nerd Identity^{6,7} as a framework. The use of nerd identity as characterizing the stereotypical engineer proposes a dichotomy between the nerd and the non-nerd. The broader implications of this dichotomous relationship can then be explained using Social Identity theory, which poses that two groups will seek to make themselves distinct and separate by embellishing their own positive characteristics (in-group) and the negative characteristics of the other group (out-group). Barriers to entry into the engineering profession may be created if engineers are perceived in a negative way by non-engineers, or people unsure of their position with regard to engineering, due to exposure to negative characterizations of engineers in the media.

Literature Review

Social Identity Theory

In Social Identity Theory, Tajfel and Turner⁵ explain that both within group and between group interactions have significant impacts on building identity. The in-group is defined as the group to which the person actively engaging in identity building believes they belong⁵. The out-group is defined as the group that the person actively engaging in identity building chooses to compare to the in-group where they belong⁵. Tajfel and Turner claim that “(t)he aim of differentiation is to maintain or achieve superiority over an out-group on some dimensions”^{5,p.183}. Tajfel and Turner suggest that there are three main assumptions of Social Identity Theory that are critical to understanding how group interactions can lead to identity building. The first is that individuals will strive for a positive social identity to maintain a positive self-concept⁵. Second, this positive social identity is based off of the comparisons made between the in-group and out-groups that provide favorable comparisons⁵. Third, if positive social identity is not reached, a person will seek to leave the in-group and find another group to join that will help create a more positive social identity⁵.

Nerd Identity

The study of nerd identity has become a growing research field in media studies. According to Kendall, nerd identity can be defined by the following criteria: 1) Computers are an important but complicated type of technology in our society, 2) Nerds are the people who understand and enjoy working with computers, 3) The people who understand and enjoy working with computers are nerds, 4) Nerds are socially awkward and undesirable to the opposite sex, and 5) Nerds are white males⁶. Those who are nerds are typically portrayed as technology and math loving, socially awkward, white male sexual failures⁸. While the term nerd can be dated back to the 1950's where it first appeared in Dr. Suess's book, *If I Ran a Zoo*, and early versions of the nerd on television can be dated to the 1960's with characters like Richie on *Happy Days*, the stereotypical nerd persona is highly attributed to the *Revenge of the Nerds* franchise in the 1980's⁸. It is also in the 1980's when television and film started to portray the relationship between nerds and cool jocks as a contentious relationship where nerds were made fun of and

physically harmed by the cool jocks⁸. This contentious relationship is what Quail calls the hip/square dialectic, where the hip (or cool jock) persona sees the square (or nerd) as an enemy. In this relationship, the jock continually taunts the nerd in a show of hegemonic masculinity. This hip/square dialectic can be situated as in-group and out-group using the terms of Tajfel and Turner's Social Identity Theory⁵.

The study of nerd identity is a new and growing field with many researchers studying the development of nerd identity through portrayal in the media. For example, Kendall studied the portrayal of nerd identity and how it is contrasted by black identity in the Weird Al Yankovic music video entitled "White and Nerdy"⁶. Weird Al's cover of the song "Ridin' Dirty" portrays the stereotypical nerd (white, male and socially awkward) against masculine black male counterparts. A major theme of this music video is that a nerd must be awkward, white and male and cannot be cool and black. Quail studied the presence of William Hung as a reality television star⁸. William Hung was made famous when this nerdy, Asian engineer performed a rendition of Ricky Martin's "She Bangs" on a season of *American Idol*. Hung became a star after his appearance as a "loser" on *American Idol*, though Quail contends that Hung's popularity was due to his loser status and the audience's desire to make fun of the engineer. In many studies of nerd characters portrayed in the media, we see a desire to provide a stark distinction between the nerd who is awkward, weak and white and the cool person who is masculine and cool. Social Identity Theory shows us that, with nerds being the out-group and jocks being the in-group, the negative characteristics of the nerd are accentuated in order to make the masculine jock look cooler⁵.

Examples of Science and Engineering in Popular Media

The following section provides an overview of how the three popular media examples (television or comic strip) selected for this study represent science or engineering characters: *The Big Bang Theory*, *Mythbusters*, and *Dilbert*. I selected these articles mainly due to their popularity in the mainstream media. It is important to note that this overview was not developed through an in-depth content analysis of all available media from these articles. Instead, this overview is developed through the researchers personal exposure to each article as well as information provided in Wikipedia articles⁹⁻¹². While Wikipedia is typically not an appropriate source of evidence for educational research contexts I believe that my use of summaries from Wikipedia is justified in this context. Wikipedia is a socially constructed encyclopedia that is policed by its users. Therefore, the entries on Wikipedia are socially constructed by users. An entry on any of the media articles selected in Wikipedia provides a socially constructed summary of the articles and its themes. This summary construction from Wikipedia can be used to determine a picture of characters on the show that is constructed by the audience. Because this study is about social perceptions of media articles, Wikipedia is an appropriate source. Based on outcomes from this study, future works will consider a more detailed content analysis of each media article.

This review of the three media articles is organized around three specific areas of identity: race/ethnic identity, gender/sex identity and identity surrounding ability to socially interact. These three areas are a major focus due to the prevailing stereotype of engineers being white males who are socially awkward. Kendall found that the predominant stereotype of 'nerd' was related to those in the computer science community⁶. A 'nerd' was further defined as the white (or Asian) male that wore black pants, a white shirt and thick rimmed glasses.

Race

In the three articles chosen for this study, very little time or discussion is devoted to the issue of race. In fact, issues of race seem altogether ignored. All of the major characters for each article are stereotypical white males. There are a few instances of racial minorities present in all three articles. In *TBBT*, Raj is an Indian astrophysicist. In *Dilbert*, Asok is an Indian engineering intern. In *Mythbusters*, Grant is an Asian-American robotics specialist. All minority representations in these articles are Asian or Indian. There is no representation of African Americans or Hispanics in any of these articles as reoccurring characters. It is important to note that the minority representations are also considered more minor characters when compared to their white male counterparts.

It seems that the issue of race is largely ignored in all three articles. Are the writers of these articles choosing to ignore issues of race in an attempt to say that race is not salient in a person's choice to become an engineer or scientist? Harlon Dalton reminds us that "race *matters* in America..."^{13, p.65}. "For when I am e-raced, I am denied an identity that is meaningful to me and am separated from people who are my flesh and blood."^{13, p.72} We cannot ignore the issue of race in engineering because race is important in America. By choosing to ignore race, these media articles are not helping to provide a picture that anyone of any race can be an engineer. Instead, they are eliminating a potential platform to give people of different colors and nationalities a persona in engineering that they can identify with. In *TBBT*, discussions of race and nationality are limited to disparaging comments made by Raj about his own Indian heritage and culture. Raj is known to make comments about how he hates Indian food and he never wants to have to move back to India because there are so many people there. The impression that is given by these comments is that Raj wants to give up his Indian group status to move to a new group, such as the American group that is habituated by his friends. Raj seems to desire to move from his Indian in-group to another group because his self-concept has been affected and he is trying to provide for himself a more positive social identity⁵. This is reminiscent of the examples given by Dalton of members of the Black community giving up their 'blackness' to become more white in order to be seen as more successful or acceptable in the white community.¹³ By Raj wanting to discard his Indian heritage, *TBBT* could be sending a message that if minorities want to participate in the science field, they will be required to acculturate to a more White, Western identity to fit in or be accepted, which Phinney suggests many immigrants will be pressured to do when they move from their home country to another country¹⁴. This is an

extremely negative message to send, especially when we realize that Raj's character is one of the strongest minority presences in all three media articles.

Gender

In these three media articles, gender is slightly more represented than race. The term sex has been used historically to represent the biological distinction between males and females. There is concern that the term sex is not a representative term because differences between males and females can be described based on the interactions between biological and social constructed influences¹⁵. Therefore, we choose to use the term gender in this case. Gender is defined as the distinction between male and female. This distinction is defined by biological and socially constructed influences. In all three articles, there is representation of females in engineering and science roles. Despite this representation, there is still a perception that engineering is for the white male. When females are represented in science and engineering roles, they are often unappreciated or forced to cover for their intelligence. As Cech argues, many people in the LGB community can be gay as long as they do not flaunt their homosexuality¹⁶. In a similar fashion, in these articles women can be engineers as long as they do not flaunt their intelligence.

In *Dilbert*, Alice is the lone female engineer in the group. She is technically skilled yet underappreciated for her efforts. She is the lowest ranking full time engineer in the group. In *Mythbusters*, Kari is a skilled scientist that works with Grant and Tory. She is not afforded the same status as Adam and Jamie who are the figure heads for the show. In *TBBT*, Amy and Bernadette are both brilliant scientists in their respective fields. Amy is not respected by her boyfriend, Sheldon. Bernadette must cover for her intelligence so as not to alienate her boyfriend, Howard.

This representation of women sends a clear picture that, though women may be skilled in science and engineering, they will never be as respected or as high ranking as men in science and engineering. Bernadette's actions could even send the picture that if women are seen as smarter than men, women will have to give up the prospects of relationships with the opposite sex.

Penny is the main female character on *TBBT*. She is portrayed as a ditsy, sexy blonde waitress/actress that the opposite sex is almost always attracted to. In fact, it was her sexual appeal to the four scientists that is the premise of how the show originally started. The four scientists became friends with Penny because they thought she was sexually appealing. Amy Farrah Fowler is portrayed as homely and plain. She is portrayed as anything but sexy and has extreme difficulty interacting with the opposite sex. Bernadette is portrayed as a cute, petite scientist but in no way is portrayed as sexy or alluring. I believe that this choice of characterization sends a strong signal that if you are an engineering female, it will be difficult for the opposite sex to see you as sexually attractive. Penny's characterization can also send a message that women are only meant to be sexual objects. Neither message is an appropriate

message to be sending. We do not want to strip women of their potential to be sexually attractive but we also do not want to make women feel that sexual attractiveness is all they are good for.

Another area for concern in regards to gender is the idea of characters acting like ‘one of the boys.’ On *Mythbusters*, Kari could be seen as ‘one of the boys.’ She participates in challenges that blow stuff up, shoot simulated people, and drive fast cars. Does Kari act like one of the boys to be accepted by the men she works with and the men that watch *Mythbusters*? Or is this truly part of her personality to enjoy these types of activities? Studies have been conducted that show that women in engineering fields can feel pressure to act like one of the boys in an effort to gain acceptance and credibility in the workplace¹⁷. Without asking Kari about perspective, it is dangerous to assume that she is acting like one of the boys to gain acceptance. I can only state that this is a potential issue with this particular media article.

Social Interactions

A large portion of the humor portrayed in both *Dilbert* and *TBBT* deals with the social interactions between the main characters and other people in their world. The main characters in each of the media articles are portrayed as socially awkward, especially around people of the opposite sex. In one *Dilbert* comic strip, Dilbert is pictured with a flower pot on his head as he attempts to meet a woman at a bar. He tells the woman that he read that women find creative guys much more attractive and so he was attempting to be creative by wearing a flower pot on his head. The woman was confused by his efforts. In *TBBT*, Sheldon is pictured developing an algorithm for making friends after he decides the friends that he has are not adequate. The idea of engineers being ill-equipped to deal with social situations seems to be a prevalent issue. A 2007 article in the *ASHREA Journal* sought to teach people skills to engineers because schools often focus on technical skills and not the skills necessary to effectively work with people in the workplace¹⁸. While it may be true that some engineers could use some refinement in the area of people skills, much of what is represented in the media about engineers’ ability to relate to people is extremely exaggerated and can be detrimental to potential engineers entering the field.

Importance of this Work

The media articles selected for this study build a picture of engineers that lacks diversity in regards to race and sex/gender, as will be discussed in a later portion of this paper. The media articles also provide an extremely negative picture in regards to an engineer’s ability to interact socially with other people. There is concern that the picture that is developed may potentially cause a barrier for people considering to enter in the field of engineering. To protect their social identity, people may choose not to enter the field that is stereotyped as white, male, heterosexual and socially awkward. As Ashforth and Mael explained “Symbolic interactionism holds that meaning is not a given but evolves from verbal and nonverbal interactions of individuals.”^{19, p.27} We can take this to mean that the verbal and nonverbal interactions of the individuals, or characters in the media articles, are transmitting perceived characteristics of engineers to the

audience, thus creating a group that potential engineers either do or do not fit into. Ashforth and Mael later discuss how the use of charismatic leaders, advertising, logos and mascots has been used to define and sustain an organizational identity¹⁹. We can look at the characters like Sheldon Cooper, Dilbert and Jamie and Adam as charismatic leaders or mascots that are being used to build the picture of engineers that the ‘engineer in-group’ is expected to follow as their prototype. It is critical that we know how these characters are being viewed and used to build pictures of engineers. It is also critical that we understand the positive and negative effects that the pictures that are built can have on people’s willingness and desire to enter the field of engineering. The media can have a significant impact on what people think of engineering and whether they want to be an engineer or not. As Moghaddam states,

“Because social comparison processes have such a powerful influence in intergroup relations, the ability to influence social comparison targets is of the highest importance. This ability is part of the enormous advantage enjoyed by those who control resources and the media...”^{20, p.97}

This means that people who control media sources have significant power in developing and sustaining the pictures of groups portrayed on television. To go further, the characters that are represented in the media have a strong ability to shape the pictures that we hold of certain professionals, including scientists and engineers. It is critical that we utilize the powerful resource of the media to send out more positive images of engineers for the world to be exposed to.

Methods

This study used qualitative research methods for the purpose of gaining new insight into how certain media articles that portray science and engineering characters affect the picture of an engineer that participants develop²¹. It is the intent of this study to look at mental pictures of engineers that are built through exposure to specific media articles that portray science and engineering characters. This study seeks to answer the following research question:

***RQ1:** Does viewing selected media articles with engineering themes impact participants mental pictures of engineers?*

Interviews were conducted to gain understanding on the participant perspectives²². This study used the Interview Guide approach described by Patton²³, which calls for the development of an interview guide to provide general topics that should be covered during an interview. The Interview Guide approach allows for flexibility in the interview so that experiences mentioned by the participant can be explored in further detail. Interviews were supplemented with several selected media artifacts (explained in further detail in the *Selection of Media Articles* section) that the participants were asked to view so as to provide their perspective on if viewing the articles impacted their picture of an engineer. This artifact-based interview method was intended

to standardize the media input that participants would be asked to consider so that comparisons could be made among participants.

Development of Protocol

A total of six questions were developed for the interview protocol. The number of questions in the interview protocol was limited to six due to the fact that participants would be asked to watch approximately ten minutes of media articles as part of the interview process. To keep the total interview length under 60 minutes, six questions were generated. Questions were reviewed and refined through a peer review process to ensure that question wording was clear. The intent of each question was described to the peer reviewers and further refinements were made. The six questions that were used for the protocol are:

1. Close your eyes. In your mind, picture an engineer. Picture what this engineer looks like, what they like to do, how they interact with people.
2. Can you describe this image that you pictured in your head?
3. What experiences or sources have influenced this picture? Think of all of the different influences that contributed this picture and describe them.
 - a. If they do mention media sources...
You mentioned _____(media source)...can you tell me a little more about this?
 - b. If they do not mention media...
Are there any media sources that influenced the picture that you have in your head?

Media Articles are show to participants

4. So, if you had a picture in your head just based on these media articles, could you describe that picture to me?
5. From what you just watched...can you tell me about similarities and differences between the picture in your head and the one that is presented in these articles?
6. Would you identify yourself as an engineer?

Selection of Media Articles/Bias

A significant portion of the interview process centered on the use of several media articles. The media articles were meant to represent a typical portrayal of engineers in the media. While engineers are not represented as often as doctors or lawyers in popular media, there are several media articles that can be classified as portraying engineers. Three particular media articles were chosen for this process. The comic strip *Dilbert* was chosen because it is a popular weekly comic strip that follows the life of an engineer named Dilbert. The Discovery Channel show *Mythbusters* was another media article chosen because it is well-known for making science and engineering methods look fun. Finally, the serial comedy *The Big Bang Theory* was selected

for this study because it is a popular show on network television that focuses on the lives of physicists and engineers.

For each of these media articles, there are hundreds of potential clips that could be chosen to be representative. The researcher for this study is very familiar with each of these media articles and took on the task of selecting four *Dilbert* cartoons and two clips from each television show to be representations of each article. In this process, clips that were selected were affected by the researcher's bias and could potentially affect the responses provided in the second half of the interview process.

The researcher identified three main themes for each media article based on knowledge of the history of the media articles. These themes can be considered the researcher's bias in media selection and should be stated for use in analysis. For *Dilbert*, the three main themes identified by the researcher are 1) social awkwardness of engineers, 2) engineers believe that all non-engineers are ignorant and 3) all engineers are white males. For *Mythbusters*, the main themes are 1) science is fun, 2) white males are the leaders in engineering and 3) science is about blowing stuff up. For *The Big Bang Theory*, the main themes are 1) social awkwardness of engineers, 2) engineers have extreme difficulty interacting with the opposite sex and 3) engineers are white males. The themes identified in these media articles reflect the nerd identity theory presented by Kendall that show that nerds are socially awkward white males⁶. When selecting the representative clips used for this study, clips were chosen in an effort to reflect the three major themes identified by the researcher. Video clips and comic strips were also chosen in an effort to show a representative sample of main characters to the participants.

The content of the comic strips and videos selected for this study will be described in more detail below. If you would like to view the *Dilbert* comic strips, please visit <http://www.dilbert.com>. If you would like to view the *Mythbusters* video clips, please visit <http://dsc.discovery.com/tv-shows/mythbusters>. If you would like to view the *The Big Bang Theory* videos, please visit <http://www.cbs.com>.

Participants were first presented with four *Dilbert* cartoons to view. The cartoons were displayed using Powerpoint on the researcher's computer. Participants were allowed to take as much time as needed to read the comic strip before asking the researcher to move to the next strip. The first comic strip (dated 3/19/12) involves Wally and Dilbert. Both men are dressed in their typical dress of a white collared shirt and black pants. Both men wear glasses. The two have a discussion about whether they should have a conversation. Dilbert states that he does not need to talk with Wally but does not mind standing near him. Wally says that Dilbert gets him. Dilbert responds by claiming that they are acquaintances.

In the second comic strip (dated 3/18/12), Dilbert is at a party with a potted plant on his head. A woman comes up to him and asks him about the plant. Dilbert is not in his typical white shirt and black pants but instead is wearing a green shirt with blue pants and holds a drink in his

hands. Dilbert begins to explain that women prefer creative men. The woman says the plant is not creative; it is just random. Dilbert then explains that because of some of the physiological symptoms that he is observing occur to the woman, it shows that she is interested in him. She states that she is in fact interested in him and Dilbert walks away to ‘shop around.’

The third comic strip (dated 10/21/11) again involves Wally and Dilbert. Dilbert is dressed in a white shirt and black pants but Wally is dressed in a green suit with flared legs with a pink shirt. Wally comments that he is now dressing at the unisex store. Dilbert informs Wally that a unisex store does not exist. Wally states that Dilbert always has to be right. Dilbert follows up by saying that “That’s the pantsuit talking.”

The final comic strip (dated 10/15/11) involves Dilbert, Alice and Asok. All three characters are seated at a table. Alice sits next to Asok. Dilbert sits on the other side of Asok. Alice begins by saying that she is so frustrated that she wants to cry. But she refuses to cry because she does not want to fall into ‘the stereotype.’ She then tells Asok that he will be her surrogate crier. Dilbert sits and watches. In the next frame, Asok and Dilbert are walking out of the room. Asok is red-faced and has his tie pulled very tight around his neck. Asok declares that it was the worst meeting ever. Dilbert comments that Asok did a good job on the high notes.

Video clips were shown immediately after the participant finished reviewing the *Dilbert* cartoons. The video clips used for this study lasted a total time of 8:14 (MM:SS). Participants are first shown two clips from *Mythbusters*. The first clip (titled “Diet Coke and Mentos MiniMyth”) shown involves Adam and Jamie performing a test on Diet Coke® and Mentos®. The video starts with Adam explaining the potential theory behind why there is such a strong reaction when Mentos® and Diet Coke® are mixed together. Adam and Jamie are seen building an experimental set up. Then the pair tests a control of Mentos® and soda water. After the control, Adam explains the different types of candies that will be used in the experiment. Jamie and Adam are shown dropping candy into a bottle of soda water. This video ends at 1:59.

The second *Mythbusters* video (titled “Drowning Cockroaches?”) that is show involves Kari, Grant and Tory working on a myth about drowning cockroaches. Grant and Tory both work to introduce the myth to the audience. Grant then explains the method that the team has developed to test the myth. They will fill small, clear plastic boxes with water, place cockroaches inside, cap the boxes and see if the cockroaches expire. All three team members are shown setting up the experiment. At the 20 minute mark, Grant provides an update that cockroaches #1 and #2 have expired. At the 30 minute mark, the team empties the containers and find that all the cockroaches have expired. This video clip ends at 3:42.

Next, two video clips from *The Big Bang Theory* are presented to the participants. The first *TBBT* clip (Season 2 Ep. 13) involves the four main characters Sheldon, Leonard, Howard and Raj. Leonard, Howard and Raj have returned to the apartment to find Sheldon working at a white board. Sheldon exclaims that he has just developed an algorithm for making friends. His

algorithm is outlined in flowchart format on a white board in the apartment and has been developed with the assistance of a children's book called *Stew the Cockatoo is New at the Zoo*. Sheldon then attempts to use his algorithm by asking someone over the phone to be his friend. He walks through the algorithm while asking the person on the phone different questions. At one point, Sheldon gets 'stuck in an infinite loop' where he and the person on the phone cannot come to an agreement about the activity they will engage in. Howard changes the algorithm to include a loop counter that will help Sheldon exit the loop by going to the least objectionable activity. Sheldon exclaims that this idea is brilliant and he is surprised that Howard thought of it. Howard asks, "Gee, why can't Sheldon make friends." Sheldon agrees on an activity and hangs up the phone. This clip ends at 6:15.

The second *TBBT* clip (Season 1 Ep. 1) also involves the four main characters Sheldon, Leonard, Howard and Raj and also involves Penny, the blonde woman who lives across the hall. The clip starts with Howard and Raj entering the apartment with a video that Leonard and Sheldon must watch. The video is of a Stephen Hawking lecture from 1974. Leonard states that it is not a good time and asks Howard and Raj to leave. Sheldon states that there is a woman in the apartment. Several jokes of a sexual nature are exchanged between Howard, Leonard and Sheldon. At this point, Penny enters the room from the back hallway wearing nothing but a towel. She asks how the shower works. Howard immediately moves towards Penny, speaks French and introduces himself. He states that he was involved in developing an orbiter around the moon (in a fashion that suggests that he is trying to impress Penny). Penny introduces herself and states that she works at the Cheesecake Factory. As Penny goes back to the bathroom, Howard tells Penny that he can speak multiple languages (again, in an attempt to impress her). After a cutaway, Penny sits on the couch with Raj. She asks him if he works at the university with Leonard and Sheldon. He looks away from her, continues to eat his food and does not respond. Penny asks if Raj speaks English. Howard informs Penny that Raj speaks English but he cannot speak to women. Penny asks why. Howard responds that Raj is 'kind of a nerd.' Howard then offers Penny a juice box. The video ends.

Sample Size/Sample Selection

For this study, a small sample size was selected due to time limitations for this study, as this study was part of a course assignment. The sample selected was a convenience sample for the researcher²⁴. Four participants were selected for this study. All participants are graduate students at a large southeastern public university. Participants were selected based on the gender of the participant (as identified by the researcher) and whether the researcher identified the participant as an engineer or a non-engineer. Though the researcher selected participants based on whether the researcher classified them as an engineer or non-engineer, the participants were given the opportunity to self-identify as an engineer or non-engineer at the end of the interview process.

Interview Process

Interviews were conducted at locations that were convenient to each participant. All interviews were audio recorded for the purpose of review by the researcher. Field notes were also recorded during each interview. For the purpose of this study, interviews were not transcribed due to the limited time in which this study was conducted. In future research, I will conduct more interviews with participants and plan to transcribe and code interviews.

Results

Participant Narratives

A thematic analysis was conducted for this study²⁵. During and after each interview, I recorded extensive field notes on the topics that were discussed by each participant. Themes were developed from these field notes. To provide context for the discussion of themes from each interview, participant narratives were developed. The narratives provide information about each participant that is relevant to the discussion of major themes from this study. Great care was used to protect the identity of the participants when developing the narratives. The information in the narratives provides information about each participant's field of study as well as background information to support how original pictures of engineers were developed.

Anna

Anna is a white, female student in an engineering department at a large, southeastern university in the United States. Anna is pursuing a Master's degree in her field of study. She has developed a picture of an engineer based on her interaction with peers and other family members, like her grandfather. Anna does not watch much television. Anna identified herself as an engineer, but was quick to say that she did not fit into the stereotypically engineer category.

Nathan

Nathan is a white, male student in the mathematics department at a large, southeastern university in the United States. Nathan is pursuing a Ph.D. in his field of study. Nathan had many friends at his undergraduate institution that were computer science majors which he attributes to being similar to an engineering major. He also has a grandfather who was an engineer that had a significant impact on his picture of an engineer. Nathan did not identify himself as an engineer.

Eric

Eric is a white, male student in an engineering department at a large, southeastern university in the United States. Eric is pursuing a Ph.D in his field of study. Much of the picture that Eric had developed of an engineer came from his interaction with engineers during an internship and through his research group in graduate school. When asked to identify himself, Eric identified himself as an engineer but was quick to note that being a graduate student was also a significant part of his identity.

Beth

Beth is a white, female student in the education department at a large, southeastern university in the United States. Beth is pursuing a certificate in her field of study. Beth has developed her picture of an engineer mainly from interactions with people that show knows, including her father and friends, all who are engineers. She mentioned that she enjoys watching *The Big Bang Theory* on television. Although she was classified by the researcher as a non-engineer, Beth self-identified as an engineer because she likes to fix things around her house and believes that a significant portion of her job is problem solving.

Original Picture of an Engineer

Participants were first asked to describe the mental picture that they have of an engineer. They were asked to describe what this person looked like and what this person liked to do. All participants described their picture of an engineer as being a **male**. The majority of participants also pictured a **white** male as their engineer. Anna and Beth shared that they typically think of engineers as awkward while Nathan only stated that engineers are not as introverted as mathematicians. *Anna's* original description of an engineer was what she would call stereotypical. She described an engineer as a boy wearing jeans and a t-shirt who likes math. She also described engineers as awkward. But she followed this statement by saying that engineers can relate to people. They are just not very outgoing.

In *Nathan's* mind, engineer's like to design things, which he said is a pretty standard story. Nathan said that engineers have stereotypical jobs designing, working with or building technology. Engineers like to tinker with things. From Nathan's perspective there was nothing notable about how engineers interact with people. He stated that engineers are not as introverted as mathematicians. When he pictured an engineer in his head, the engineer was a white male of average size with a beard. He wasn't quite sure why he pictured an engineer with a beard, but the beard stands out to him.

Much of *Eric's* original picture of an engineer focused on the type of work that engineers are involved in. Eric described an engineer as a person who works with Computer Aided Drafting (CAD) and spreadsheets. Engineers like to tell people how things work. Engineer often communicate information to line workers on the job. Typically, engineers enjoy hands-on type of work. In a personal setting, engineers are all different types of people. They enjoy watching movies to kill time. Engineers are typically inquisitive and Eric thinks that this is a characteristic of their personality. His opinion is that the typical engineer is a white male, but this can be varied as well.

Beth pictures an engineer as someone who is very smart but cannot relate very well to people. She made the statement that "If I meet someone and they are socially awkward, I think they are an engineer." Beth also mentioned that she believes that people with high intelligence have low social skills and people with low intelligence have high social skills. From Beth's

perspective, engineers are practical and logical thinkers and she believes that comes from their engineering training. Beth questioned whether people that are engineers have a greater possibility of being logical thinkers. She seemed to insinuate that people are born as logical thinkers and that logical thinkers are drawn to engineering. Beth described the typical engineer as wearing glasses, liking computers, enjoying drawing things and enjoying math. In her picture, Beth thought that engineers are usually males instead of females. And typically, she thought of engineers as white though she is not surprised when she meets an Asian engineer. She thought she would be surprised to meet an engineer that is African American or Latino.

All participants described that their original pictures of engineers were developed through direct interaction with people who were engineers. Anna mentioned interactions with a roommate's significant other and her grandfather as significant. Nathan discussed how he had many friends in computer science that he used to develop his picture of an engineer. Eric's interactions with peers in a research group and during an internship were significant to him. Beth's father and many of her friends are engineers. No participant originally cited media articles as having an influence on how they pictured engineers.

Picture of an Engineer After Watching Media Articles

After watching the media articles presented, all participants discussed themes of engineers being **awkward or antisocial**. There is a possibility that this theme was prevalent due to the clips that were selected for viewing. This issue will be addressed in the Limitations and Future Work sections. *Anna* described a new picture of an engineer that likes to explain how things work the way they do to other people and loves math, algorithms and flowcharts. This engineer has some social limitations, especially with women. The dress for this engineer was just black and white suits or jeans and a t-shirt. And based on what *Anna* saw, engineers are mostly Americans.

Nathan commented that the last few videos (referring to the clips from *The Big Bang Theory*) were nerdy or geeky in a different context to which he had spoken before. In these videos, the characters were nerdy which meant that they were extremely socially awkward and clueless about everything but their own subject. He thought that *The Big Bang Theory* played up the fact that the characters were awkward. *Nathan* also mentioned that the *Dilbert* cartoons made him think that *Dilbert* overanalyzed everything because he has no social skills. Finally, he thought that *Mythbusters* did not fit the stereotype of being awkward. Instead, *Nathan* thought that *Mythbusters* portrayed that engineers like to tinker with things. He found the media articles portrayed that more men are engineers, which somewhat matched with his original picture of an engineer. *Nathan* noted that race might be an issue, meaning that the representation of engineers is limited to White or Asian people, but that he had never really thought of this issue until now.

After watching the articles, *Eric* described that engineers are antisocial, awkward around women and they perform silly experiments. *Eric* also stated that female engineers feel a need to modify their behavior. He did not specify if this modification was in the workplace or in a social

setting. From his perspective, engineers are white males. They are nerdy, wear outdated clothing and glasses.

Beth described an engineer as a male who is socially awkward, especially in dating relationships. The videos showed engineers trying to boil social situations down to formulas. The engineers in the media articles are uncomfortable trying new things and much more comfortable just being engineers. *Beth* did mention that the experiments that were performed on *Mythbusters* were cool.

Similarities and Differences

Participants were asked to describe similarities and differences between the original picture they had developed of an engineer and the picture that was generated after watching the media articles. Though there were several similarities between the two pictures generated, *Anna* found a few differences as well. From her perspective, *Mythbusters* made engineers seem cool. *Anna* never mentioned in her original picture that engineers did not seem cool, but she identified this area as a difference from her original picture. Second, the figures on *Mythbusters* had fun and would be people that *Anna* would want to hang out with, unlike the characters from the other articles who she described as awkward.

Nathan found that engineers were portrayed more as men, which somewhat matched with his original picture of an engineer. *Nathan* thought that the media articles differed from his picture of engineers because it had not been his experience that engineers are socially awkward.

Eric noted that the media articles displayed the stereotypical antisocial behavior of engineers. This was an interesting point for him to make because there is no note of him mentioning antisocial behavior in his original picture of an engineer. *Eric* also mentioned that the shows and comics are using stereotypical behavior to be comedic or entertaining. When asked about differences, *Eric* mentioned that *Mythbusters* presents science and engineering as more exciting and fun and less analytical. He stated that engineers do a lot more real work than what is shown on *Mythbusters*.

Beth thought the similarities between her original pictures of engineers and the one developed through watching the media articles included the fact that engineers are socially awkward, engineers are very smart, engineers wear glasses and engineers are mostly white though one character was Indian which she said counted as Asian. Also, engineers are logical thinkers. When asked about differences, *Beth* admitted that the picture in her head is the stereotypical engineer. She sees her actual interactions with engineers as very different than the stereotype in her head. *Beth* noted that there are differences between her picture of an engineer, the media picture of an engineer and the real life experiences she has had with engineers.

Discussion

From this research several themes emerged. First, the theme of engineers being white males was present in both the original pictures as well as pictures developed after watching the media articles. Another theme of engineers being socially awkward was also present after watching the media articles, though this was mentioned by some participants in the early stages of the interview. Finally, several participants noted that the pictures that were generated both before and after watching the media articles did not match their interactions with real engineers.

The Nerd

All participants described the original picture of an engineer as someone who is white and male. This picture remained unchanged after the participants were asked to watch the media articles. The theme of social awkwardness was mentioned by two participants in the original picture of an engineer and by all participants after watching the media articles presented. The mental pictures developed by the participants both before and after watching the media articles fall in line with the nerd identity discussed by Eglash, Kendall and Quail⁶⁻⁸.

My Picture Does Not Match the Real Engineers I Know

Many participants described interactions with real engineers as shaping their mental picture of what an engineer looks like. While the descriptions of real engineers ranged from 'good with people' to 'female' to 'not as awkward as mathematicians,' the original descriptions of engineers still fell in line with the nerd identity that portrays nerds as white, male and socially awkward. One participant even commented at the end of our discussion that her mental picture of an engineer was in stark contrast to the real people she knew as engineers. One possible interpretation to this contrast is that the participants of the study do not realize how much their picture of an engineer has been shaped by the portrayal of the nerd identity in connection with engineers. While it isn't conclusive that the shaping of their picture is due to the media articles specifically used in the study, it cannot be coincidence that the nerd identity that is so prevalent in television, film and other forms of media was so closely connected to the pictures that the participants of this study developed, both before and after the media articles were introduced.

It is also important that we note that, at least for one participant, the picture of an engineer that was developed was very different than her interaction with real people. Beth's picture highlights what many would deem as the negative characteristics of the nerd identity, specifically that the engineer can only be white and male and is socially awkward. It is possible that, without realizing it, this participant was holding onto the negative aspects of the engineer/nerd identity to provide contrast with the non-engineer/hip identity. Tajfel and Turner's Social Identity Theory may offer a picture as to why this may be occurring⁵. Beth realized that her mental picture of an engineer held many of the negative aspects of the nerd identity even though the real engineers that she knew did not match this mental picture. It is possible that Beth

was holding onto the negative characteristics of engineers, thus classifying engineers as an out-group.

Conclusions

Current popular media portrayals of engineers and scientists show these professions to be made up of nerds. While there is a movement to push the nerd identity to be considered 'cool,' there is a trend that the nerd is intended to bring humor to a plot due to his socially awkward characteristics. This portrayal of the engineer as a nerd has a potentially negative impact on how people, both engineers and non-engineers, view the picture of the stereotypical engineer. While the participants in this pilot study discussed interactions with real engineers that helped shape their mental picture of an engineer, there is the potential that some people may not have interactions with engineers on a regular basis. For those who do not interact with engineers on a regular basis, the exposure to media representations of engineers and scientists may be the only 'interaction' they have with people in an engineering career. With only negative stereotypes to view, these people may find that the nerdy white male engineer-type is a category they just cannot fit in.

Limitations

There are several limitations that were part of this research study that should be discussed. First, the media articles for this study were selected on by the knowledge of the researcher and not through part of a larger content analysis. While the researcher has significant knowledge of the the articles selected, there is acknowledgement that there is potential bias in the selection of the clips used to represent the articles used for this study. Second, the sample of participants for this study limited. While the purpose of this study was not to generalize to a larger population, there is acknowledgement that the sample population did not represent a diverse population. Third, the analysis of the qualitative data was limited to thematic analysis of fieldnotes only. This was the original intention of the study and therefore , great care was taken to take detailed fieldnotes during the interview process. It is possible that with more time and resources, transcriptions and coding could provide more details about the themes developed from this study.

Recommendations for Future Work

One significant area of future work would include conducting a content analysis of the media articles selected as part of this study. This content analysis could identify the main themes that represent a picture of engineers in each of the media articles. The themes generated from this study could provide a representative picture of how engineers and scientists are represented in the media. We could use this representation to help define new representations of engineers that could be developed in new media artifacts. A content analysis could also provide greater

reference for selecting representative clips for use in the artifact-based interviewing for this study.

A second area of future work would be a follow up to this study that would include participants that have not chosen a college major, participants that have chosen a college major (engineering and non-engineering) and participants that are currently practicing professionals (engineering and non-engineering). This study could provide information on the perceived supports or barriers that are present due to the current representations of scientists and engineers in the media. These supports and barriers, in conjunction with the current representation of scientists and engineers in the media, can be used to define new representations of engineers and scientists in the media.

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