MPC MAJOR RESEARCH PAPER

Girls on Film:
Gender representation in STEM photographs

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ABSTRACT

This Masters of Professional Communication (MPC) Major Research Paper (MRP) will investigate how commercial, STEM-centric imagery consumed across various visual media outlets can encourage and even reinforce the gender gap in STEM. My research questions for this project are as follows:

o Are females and males equally represented in the most downloaded commercial photos on the most popular stock photography websites in North America, specifically Fotolia and IStock?

o In commercial, STEM photos with both males and females present, does one gender generally take the “leadership role” in the photo (as defined)?

o In commercial, STEM photos with both males and females present, does one gender generally outnumber the other?

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INTRODUCTION

In today's increasingly competitive and complex economic and technological world Western countries are continually facing a shortage of formally educated workers in STEM fields. This deficit has a negative impact on the competitiveness of these nations in the current economic climate (Bhatt, Blakeley, Mohanty, & Payne, 2013). Furthermore, The National Math and Science Initiative projects a 17% increase in STEM jobs over the next ten years (2014). Although women in the United States earn 14% more Bachelor's Degrees than men, only 24% of scientists and engineers are female (Beede, Julian, Langdon, McKittrick, Khan & Doms, 2011). In Canada, the situation is mirrored - just 22% of the workers in STEM fields are female (Alphonso, 2014). Not only does Canada have disproportionately low female employment rates in these fields, women are exiting STEM careers prematurely at an increasing rate (Alphonso, 2014). Women are being paid less than men who hold equal positions in STEM, and feel undervalued and trivialized in male-dominated workplaces (Alphonso, 2014). Concern in the UK is even more drastic; females make up 13% of the STEM workforce, which studies indicate is a decline from previous years (Botcherby & Buckner, 2010). Although UK parliament passed the Equal Pay Act in the 1970s, women are still being paid approximately 15% less than their male colleagues (McLain, 2013).

In Toronto, Canada there are a number of ongoing initiatives that have

been created to encourage female students to pursue STEM education and careers. In 1989 Ryerson University, for example, initiated the Women in Engineering Program to inspire female high school students to pursue engineering as a career. This multi-faceted initiative includes outreach programs, guidance services and a Research Opportunity Program in Engineering and Science (ROPES). ROPES provides high school students the opportunity to gain work experience in a science or engineering lab on Ryerson's campus (Hydro One, 2013).

While Ryerson's program has successfully and continuously attracted small numbers of ambitious female participants, the issue of a lack of females enrolled in science, technology, engineering and math (STEM) extends beyond one institution. Nearly two and a half decades later, the program has evolved and developed several partnerships with organizations looking to rectify disproportionate gender representation in STEM (Hydro One, 2013).

In March 2013, Hydro One and Motorola announced a new partnership with Ryerson University, the University of Ontario Institute of Technology (UOIT), the University of Waterloo, and Western University to increase female enrollment in STEM programs (Hydro One, 2013). The *Hydro One Women in Engineering University Partnership* consortium received $1.4 million to spend over four years (Hydro One, 2013).

The goals of this public/private partnership are to develop new outreach

programs and to enhance the undergraduate experience for female students enrolled in engineering. Of course, a broader perspective reveals the motivation for this partnership is only a microcosm of a global issue. Indeed, educational institutions, toy companies, recruiting agencies and large corporations have all attempted to address the gender gap in STEM through a variety of innovative and experimental marketing and branding efforts. However, these progressive efforts do not form the majority; many organizations addressing STEM continue to apply more traditional marketing strategies and gender stereotypes to their

Figure 1 Stock photo example 1
Source: www.blumenbecker.com

Figure 2 Stock photo example 2
Source: www.@work.com

Figure 3 Stock photo example 3
Source: acmetechservices.com

campaigns and outreach and, in doing so, do not take into account the disparities of gender in STEM (see figures1-3).

Traditional marketing and branding often includes sourcing images from popular, stock photography companies (Frosh, 2011). Stock images are also frequently used in magazines, blogs, and newspapers (etc.) as “filler” images that align with the text or story (Ward, 2007). As this research into the promotion of STEM activities will show, much of the circulating promotional material contains both implicit and explicit forms of visual stereotyping, not to mention visual messages that reinforce stereotypical gendered attitudes that, as I will argue, risk perpetuating the gender gap in STEM fields.

As this research will argue, it is important to address the gender gap in STEM because of its potential to aid the projected labour market deficits, not to mention promote greater gender equality (Bhatt et al., 2013). Meeting the demand for highly qualified personel (HQP) in these fields will also be a positive contribution to these countries’ ”knowledge economies”; developing a workforce prepared for the ”knowledge economy” is crucial as the manufacturing economy in western countries continues to struggle (Bhatt et al., 2013). Moreover, it is crucial to explore this gender gap, as it is a strong indicator of gender values, gender perception and gender equality.

Scientific and technological knowledge is becoming more important for citizens to participate in contemporary societies. Political issues regarding

climate change, government surveillance, data mining, and reproductive technologies are examples that all require a certain level of scientific and technological understanding in order for citizens to make informed decisions. Moreover, STEM fields hold value and prestige in western societies and low female involvement in these disciplines will reproduce inequality (Mendick, 2013). Lastly, in recent years, western countries have made substantial investments in STEM. Ideally, these investments should benefit a diverse population. In sum, while there are numerous recognizable economic gains that can be made by increasing the number of women in STEM fields, the issue can be understood as primarily about gender equity and social justice. The literature review will introduce Media Effects theories and the way this diverse area of study can inform our understanding of the connection between STEM fields and the stock photography industry.

LITERATURE REVIEW

The gender gap in STEM has recently become an area of significant research. To date, a multitude of studies have been undertaken in order to make sense of and mitigate the gender division in STEM. This literature review will cover Media Effects theory as a tool and methodological approach for thinking about and interpreting the power of media and visual culture. This literature review will also engage with research on the pervasive cultural role of stock photography in contemporary media and culture.

1) Media Effects

Media Effects is an expansive area of research that refers to a body of theories that study media's persuasive effects and how the media can influence individual behaviour and socio-cultural norms. Scholars in the field look to a wide variety of media including news, film, video games, photography, music, radio etc. to help explain and gain perspective societal issues. Media Effects theories are most commonly applied in communication studies and sociology but are also used in political science, education, and psychology (Bryant, Thompson & Finklea, 2012).

Early models of Media Effects theories tend to propose a one-way communication model with a sender (the media) and a receiver of (the audience) (Shannon & Weaver, 1949). For example, the "hypodermic needle" or "bullet" theories suggested media messages are akin to strong drugs or weapons that have commanding influence on vulnerable audiences (Lasswell, 1927; Lippmann,

1922).

More recent theories emphasize the role of the receiver or audience and emphasize a two-way dialogue between the sender (the media) and receiver (the audience). For example, the “limited effects” theory takes social status and pre-existing characteristics of different audiences into account when determining their interpretations of a message (Klapper, 1960; Lazarsfeld, Berelson, & Gaudet, 1944). As these two-way communication theories have evolved researchers have begun to suggest that certain demographics (for example, children) can be regarded as more susceptible to media influence than others (Bryant et al., 2012; McCombs & Shaw, 1972; McLuhan, 1964).

Media Effects theories are commonly recognized for exploring headline-grabbing issues like violence, drug use, moral panic or propaganda. However, more recent uses have addressed the effects of the subtleties present in media texts (Bryant et al., 2012). The Media Effects theories that will be reviewed and applied in the discussion section of this study are the following:

1A) Agenda-Setting Theory

Agenda-Setting theory suggests that the media affects *what* audiences think about, not how they think. Proponents of Agenda-Setting theory refer to media corporations and influencers as “gatekeepers.” These agencies decide what is important and what will be promoted or left out of media content (Cohen, 1963; Lippmann, 1922).

Consider the following scenario in relation to Agenda-Setting theory. In 2013, H. Mendick and M. Moreau interviewed six web authors responsible for the content of popular STEM websites in the UK. They found that the web authors viewed themselves as journalists that were obliged to represent the truth (Mendick & Moreau, 2013). Consequently, women were rarely featured in their work because they only make up a small fraction of the STEM workforce in the UK (Mendick & Moreau, 2013). This study demonstrates the power that media "gatekeepers" have in selecting how often women are featured and the way women are depicted on STEM-centric websites.

1B) Framing Theory

Unlike Agenda-Setting theory, Framing discusses *how* to think about an issue instead of what issues to think about. Research on media Framing dates back to the early 1970s. In Erving Goffman's *Frame Analysis* he describes Framing as a "schemata of interpretation" that allows audiences to "locate, perceive, identify and label" events, experiences and materials presented (Goffman, 1974). Goffman's concept of "frame" has since evolved and these days "to frame" has been clearly defined as "[to] promote certain facets of a 'perceived reality' and make them more salient in such a way that endorses a specific problem definition, causal interpretation, moral evaluation, and/or a treatment recommendation" (Entman, 1993, p. 51). Frames are how an organization positions, represents, or "spins" an issue or concept in the media (Gitlin, 1980). Framing can "promote

a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (Entman, 1993, p. 54). Whether it is intentional or not, bias is always going to be present; according to Entman, bias is "consistent patterns in the Framing of mediated communication that promote the influence of one side of conflicts over the use of government power" (Entman, 1993, p. 54).

Chelsea A. Heuer, Kimberly J. McClure and Rebecca M. Puhl's research, *Obesity Stigma in Online News: A Visual Content Analysis*, applies Framing theory to a series of photographs pulled from digital news sources. Heuer et al. coded over 400 photographs and found that the news media routinely stigmatized obese people by framing them as inactive and non-professional (2011).

J. Kitzinger, J. Haran, M. Chimba, and T. Boyce's *Role models in the media: an exploration of the views and experiences of women in science, engineering and technology,* defines how women in STEM fields are framed in traditional media outlets. A combination of extensive coding and in depth interviews with over 26 women in STEM professions allowed Kitzinger et al. to develop categories from repeated results (2008). They found there was a lack of representation, negative representation, positive representation and a set of consistent contradictions regarding women in STEM that were prevalent in traditional media (2008). Moreover, Kitzinger et al. categorized negative representations of women in STEM and found that they were often framed in

ways that they described as “de-feminized/frumpy”, “victimized” or “socially incompetent/isolated” (2008).

Media Framing’s effect on young girls’ career selection is illustrated in S. Cheryan, C. Handron, L. Hudson and V. Plaut’s *The Stereotypical Computer Scientist: Gendered Media Representations as a Barrier to Inclusion for Women*. Cheryan et al. explore undergraduates’ attitudes toward computer scientists by exposing them to fabricated news articles that either do or don’t correspond to conventional stereotypes about computer scientists (2013). The females that read articles wherein the computer scientist was represented unconventionally were interested in learning more about computer science, while the females who read about the stereotypical computer scientists were understood to be less interested in learning more about computer science (Cheryan et al., 2013). The males in the study, however, did not report a discrepancy in interest based on the articles (Cheryan et al., 2013). Cheryan et al.’s findings are an example of the potential power that media stories and stereotypes can have on young womens’ interests.

1C) Cultivation Theory

Cultivation theory contends that repeated consumption – or cultivation – of fictional or non-fictional themes in the media will cultivate the belief that these themes are an accurate depiction of reality (Gerbner, Gross, Signorielli & Morgan, 1980). For example, given the abundance of crime television shows the

public might assume that at least 10 percent of men are police officers or detectives whereas in reality it is really only about one percent (Dominick, 2005). Cultivation theory researchers are generally concerned with frequent and consistent themes concerning race, ethnicity, gender and violence (Gerbner et al., 1980).

Cultivation theory also suggests that stereotypical representations of women can significantly influence and inform audiences' ideas about women. In Murphy's psychological study, *The Impact of Factual versus Fictional Media Portrayals on Cultural Stereotypes*, she showed both male and female participants videos featuring stereotypical versus non-stereotypical women. The results indicated that after repeatedly seeing a stereotype, participants began to make particularly consistent assumptions concerning, in this case, sexual harassment (Murphy, 1998). Moreover, Murphy discusses how "exposure to stereotypic and counterstereotypic portrayal primes consistent interpretations of unrelated events" (Murphy, 1998, p. 3). Other studies that involve females, media exposure and body surveillance found that females who consume sexually objectifying media have a much higher chance of internalizing media-friendly beauty ideals and of objectifying themselves (Aubrey, 2006; Vandenbosch & Eggermont, 2012).

Cultivation theory outcomes can also be used to observe instances of improving equality and the promotion of social change. B. Harper and M. Tiggemann (2008) found that young women who consistently viewed images of

powerful women in lead roles developed increased positive self-perceptions and set higher career goals for themselves (Harper & Tiggemann, 2008).

Together, the assumptions of these three Media Effect theories – Agenda-Setting theory, Framing theory and Cultivation theory – describe media consumers as being members of a vulnerable and potentially impressionable population. In the pursuit of selling goods and services, companies and media creators are described as participating in "consistent framing" in favour of "capitalism, patriarchy, heterosexism, individualism, consumerism and White privilege, among other deeply entrenched values that help allocate power in American society" (Budd, Craig & Steinmen, 1999, p. 175). Given the pervasive of the medium in our always-on and screen-filled culture – and given the ability of those with financial means and specific social or political agendas to purchase and promote particular media properties – it is imperative to understand the dynamics and potential effects of media framing of media content. The following section of this literature review explores the role of the visual ,media in our media-saturated culture and the potential ways visual imagery can persuasively impact individual and collective opinions and world views.

2) Visual Culture and Influence

Dr. Paul Martin Lester outlines the importance of visual communication in his book, *The Syntactic theory of Visual Communication* (2006). He relies on critical

and cultural theorists like Noam Chomsky, Fernande Saint-Martin, Irving Biederman and Roland Barthes to assert the importance of the visual communication process. Lester argues that individuals think in images and that text represents pictures or photos through literal representation or imagination (2006). His theory recounts the evolutionary history of the image and the importance of imagery for modern day journalism and media (2006). He hypothesizes that we are becoming an increasingly visual society and that "reading is losing to watching because viewing requires little mental processing and is much quicker and more efficient" (Lester, 2006, p. 1). Lester posits that "Mediated words and pictures have equal importance in the communication process" (2006, p. 1).

Lester is only one example in the large body of research that discusses the importance of the image and of visual culture for human culture and societies. In 1972, for example, author and art-critic John Berger wrote the book *Ways of Seeing* based on his 4-part BBC documentary series. Berger suggests that images are often comprised of familiar articles or subjects (1972) and that while people view images through a socially conditioned lens, these images also socially condition people (a two-way communication model) (1972). To substantiate his claims, Berger examines the circulation of reproduced paintings and copies of Renaissance artwork to argue that the depictions of, for example, the women featured in these works have created and shaped stereotypes of women (1972).

Berger's research and other critical, theoretical, and empirical work in visual communication and culture is essential to explore because there has been a substantial increase in our consumption of visual media throughout the 20th and 21st centuries. Whether it is a printed poster in a bus shelter or a banner-ad on a mobile device, images are becoming increasingly prevalent in our everyday lives (Brumberger, 2011; Lester, 2006; Vartanian, 2012). As Lester observed, images are easier for the human mind to process – hence, for example, the colloquial saying, "A picture is worth a thousand words" – which drives marketers to opt for more image-laden material as opposed to relying on the written word (2006).

Having established the strength and persuasive power of visual imagery, it is important to examine where images in our media saturated culture come from and how they are created. To engage with these questions the following section will discuss stock photography as a dominant and influential resource for commercial imagery.

3) Stock Photography in Contemporary Media and Culture

As images continue to shape stereotypes, attitudes and behaviours, it is of utmost importance to be able to interpret and understand where images in our media saturated culture come from and what they represent. It is estimated that over 70% of the images used in advertising and marketing efforts are sourced from stock photography websites (Frosh, 2001). Advertisers are known for using

stock photographs because the photographs are “professional grade” and they are much less expensive than commissioning customized photo shoots (Frosh, 2001). Under the stock photography umbrella we find commercial photographs, journalistic photographs and editorial photographs. For the purpose of this paper, all references to stock photography will be referring to commercial photographs unless otherwise stated.

Stock photographs are also promoted to independent web developers and designers to make their work more appealing: “an easy way to make your website more professional is to incorporate stock photography” (Westfall et al., 2012). Moreover, in his historical account of the stock photography industry, Matthias Bruhn asserts that stock photography companies almost solely market their product to mainstream art directors and advertising agencies (Bruhn, 2003). Stock photography has also been referred to as a crowd-sourcing tool that is controlled by the “invisible hand” (Brabham, 2008), meaning that supply and demand will continuously reach equilibrium without any agent intervention (Rothschild, 1994). The workings of most stock photography websites are such that professional photographers will upload their work for purchase; in turn, stock photography customers have a wide variety of styles and work to choose from (Brabham, 2008).

Dr. Paul Frosh does an excellent job of debunking the idea that stock photography sites are socially beneficial organizations by “lifting the veil on a

powerful force in contemporary visual culture" (Frosh, 2001, p. 635). He argues that while advertisers, art directors, web developers, and designers alike certainly do benefit from stock photography sites, the stock photography industry is an oligopoly capable of shaping social and cultural attitudes. He notes that the majority of stock photography businesses are owned and operated by only three companies - Getty Images/ Hellman & Friedman, Media PLC and Microsoft (Frosh, 2001). Through the lens of Agenda-Setting theory, Getty Images/ Hellman & Friedman, Media PLC and Microsoft could be considered the "gatekeepers" of the stock photography industry. They both sanction or "curate" all content that is sold on their sites and choose what is relevant and what will be promoted or avoided in their media content (Cohen, 1963; Lippmann, 1922).

Moreover, the purchasers of the photographs are disseminating the photos to the public for both their conscious and subconscious consumption (Frosh, 2001). In other words, the stock photo provider / purchaser relationship or interaction is only a miniscule aspect in terms of the potential ramifications or effects of the photographs (insofar as it's the photographs' dissemination through the media that is most significant in terms of their socio-cultural impact and effects). Through the exploration of stock photography companies' business models and the implications of their photographs, Frosh determined that stock photography is a major contributor to cultural production and how the general public structures societal – and, by extension, gender – norms (2001).

RESEARCH QUESTIONS

Given the omnipresence of stock photography, the potential influence of Media Effects, and the pressing issue of the gender gap in STEM, it is important that the issue of gender depictions in stock photography be examined. This Masters of Professional Communication (MPC) Major Research Paper (MRP) will investigate the ways STEM-centric imagery sourced from stock photography websites can reinforce the gender gap in STEM. The research questions for this project are as follows:

The following Methodology section discusses the process of data collection carried out for this paper to respond to these research questions. Following the Methodology section, the Findings section discusses the research questions at length with the help of Media Effects theories

RQ 1A: What is the frequency of representation of females and males represented in the most downloaded STEM photos on the most popular stock photography websites in North America, specifically Fotolia and iStock?

RQ 1B: In STEM photos with both males and females present, does one gender typically outnumber the other?

RQ 2: In STEM photos with both males and females present, does one gender take the “leadership role” (as defined) in the photo more often than the other?

The following Methodology section discusses the process of data collection carried out for this paper to respond to these research questions. Following the Methodology section, the Findings section discusses the research questions at length with the help of Media Effects theories.

METHODOLOGY

Working within a Media Effects framework this research project explores the consistency and frequency of themes in stock photography through content analysis. Content analysis is often paired with Media Effects theories because it is useful in making generalizations about themes or ideas within a body of texts (Bell, 2004; Silverman, 2005). David Silverman, author of *Qualitative Research: a practical handbook*, explains that content analysis is a reliable research method that is ideal when examining and classifying large amounts of data (2005). Mckee (2003) emphasizes that text does not have to come in the form of the written word: text can be anything that creates meaning. Thus, images, video, journal articles, radio broadcasts etc. can all be considered texts for evaluation and content analysis (Bell, 2004; Silverman, 2005).

There are two established ways to approach content analysis: conceptual analysis and relational analysis (Busch et al., 2012). Conceptual analysis is recognized for establishing the existence and frequency of concepts within a body of texts. Relational analysis examines the relation between recurring themes in a text and draws correlations between them (Busch et al., 2012). For the purpose of this MRP, only conceptual analysis will be applied to the study of STEM photographs.

In conceptual analysis a concept is chosen for examination (Busch et al., 2012). In this case, it is the frequency and role of women in STEM-centric stock

photographs. The remainder of this section looks to Busch, Maret, Flynn, Kellum, Le, Meyers, Saunders, White, and Palmquist's Content Analysis and Bell's *The Handbook of Visual Analysis: Content Analysis of Visual Images* to outline the methodology applied in this study and to describe the steps used to initiate this paper's content analysis methodology.

1) Decide How Many Concepts to Code For

Deciding how many concepts to code for is an important part of content analysis because it keeps the researcher on track and sets the parameters for the study (Busch et al., 2012). Busch et al. suggest that it is important to keep the number of concepts relatively flexible in case a major theme or issue is present in the text and should be accounted for (2012). In the case of this MRP, I look to the research questions to clarify the concepts to explore in the data collection process. The concepts or themes chosen, as specified by my research questions, are 1) gender frequency and 2) allocation of the leadership role. In keeping with Busch et al.'s suggestion that the researcher needs to keep the number of concepts flexible in order to account for unanticipated findings, as I proceed with this research I began to notice that there were major themes that developed related to race and ethnicity in the research content, namely that the stock photography images related to STEM fields featured predominantly Caucasian individuals. Therefore, as further discussed in the findings, I added

additional codes to the coding scheme.

2) Decide Whether to Code for Existence or Frequency of a Concept

When applied to text, this step can become relatively complex. However, because I am exploring photographs with key terms that explicitly imply human presence, I assume that "existence" is already present for the majority of texts. Thus, I only look for frequency in the photographs.

3) Develop Rules for Coding Your Texts

This process is one of the most important steps in content analysis: "Developing a set of rules helps the researcher insure that he/she is coding things consistently throughout the text, in the same way every time" (Busch et al., 2012, p. 5). To develop rules, the researcher must outline how many bodies of text will be coded, how they will find these texts, and how they will define the values and variables in their research" (Bell, 2001).

In this study, the research questions helped me develop the search queries and parameters. The research questions have two major themes: 1) *the frequency of females and males in STEM photos, and* 2) *the allocation of leadership roles amongst males and females in STEM photos.* In order to examine STEM photographs as equally as possible, I explore science, technology, engineering and math as individual and distinct categories for analysis. Mckee (2003) suggests that to generate results, and create meaning,

the researcher must gather or use a body of work that has at least one consistent and similar property. Thus, the keywords used are the consistent element used throughout the photo searches and content analysis.

When collecting data for the first theme, *Coding Numerical Representation of Females and Males in STEM Photos*, I use the photos from three search queries for each STEM discipline, creating 12 (3*4) queries on two different sites (Fotolia and iStock) making a total 24 (12*2) searches (see table 1 for a complete list of search queries). For example, I enter “scientist”, “male scientist” and “female scientist” into both Fotolia and iStock and code the data for each search. I then use the feature that allows users to sort by “most downloaded” or “most popular” to ensure the most used and circulated photographs are assessed. According to Dr. John Turtle, in order for content analysis to hold external validity there should be at least 25-30 texts analyzed (Turtle, 2014). Given the scope of the project, I opted for the lower number and coded 25 images for each query, making the entire sample for the first theme 600 photographs.

An important aspect of the “rule making” process is developing values and variables. Variables are the name given to a category, whereas values are the options that fall under the defined category (Bell, 2001). When answering the questions, “What is the frequency of representation of females and males represented in the most downloaded, commercial, STEM photos on the most popular stock photography websites in North America, specifically Fotolia and

IStock?" and "In commercial, STEM photos with both males and females present, does one gender generally outnumber the other?" I am able to create a simple coding scheme with only one variable. The variable was "Gender Presence" and the values were "Only Female", "Only Male", "Equal", "More Male than Female", "More Female than Male" and "Cannot Code".

SEARCH TERMS

QUERY (SEARCH TERM)	# of RESULTS CODED
Scientist	25
Male Scientist	25
Female Scientist	25
Male Female Scientist	25
Computer Programmer	25
Male Computer Programmer	25
Female Computer Programmer	25
Male Female Computer Programmer	25
Engineer	25
Male Engineer	25
Female Engineer	25
Male Female Engineer	25
Mathematician	25
Male Mathematician	25
Female Mathematician	25
Male Female Math	25

Table 1

The second theme, *The Allocation Of Leadership Roles Amongst Males and Females in STEM Photos*, was explored with a similar approach. Again, I code the first 25 most downloaded or popular photographs for each individual query. Instead of searching "Male", "Female" or "Scientist" separately, I enter

"scientist male female" so that both genders are present in the specific STEM field search (see table 1 for a complete list of search queries). With both genders present, I am able to code which gender, if any, holds the "leadership role" in the photograph. With only one search for each STEM field on both Fotolia and iStock, I code 200 photographs total (25 photographs *4 fields *2 websites). In this case, the variable is "Lead Role" and the values were "Male Lead Role", "Female Lead Role", "Equal Lead Role" and "Cannot Code". For an example of "Male Lead Role" and "Female Lead Role" see fig. 4 and 5

For both themes, defining the values and variables is crucial in order to

Fig 4 Male Lead Role Example Source: Fotolia.com

Fig 5 Female Lead Role Example Source: Fotolia.com

obtain clear results. Dr. Johnny Saldaña defines a value or code as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (2012, p. 3). The table below defines each term used to code all 800 photos. As Sipe notes, in his coding practices "all coding is a judgment call" since we bring "our subjectivities, our personalities, our predispositions, [and] our quirks" to

the process (2004, p.482-3). That being the case, I committed to making the fairest and clearest decisions I could in the coding process. If I ever questioned the value on a photograph or whether or not what it represented related to my research questions it would be filed as “CANNOT CODE”. For examples of images that I could not code, see fig. 6, 7, 8 and 9.

Fig.6 CANNOT CODE Example 1 Source: Fotolia.com

Fig.7 CANNOT CODE Example 2 Source: Fotolia.com

Fig.8 CANNOT CODE Example 3 Source: Fotolia.com

Fig.9 CANNOT CODE Example 4 Source: Fotolia.com

CODE NAMES AND DEFINITIONS

VALUE NAME (CODE NAME)	DEFINITION USED
Male only	Only one person, appears to be male
Female only	Only one person, appears to female
Equal representation (frequency)	Both males and females appear to be equally represented
More Males than Females	Appears to be more males than females
More Females than Males	Appears to be more females then males
CANNOT CODE	Coder could not code the information
Male lead role	Male appears to hold lead role *
Female lead role	Female appears to hold lead role *
Equal lead role distribution	Genders appear equal in terms of lead role. Co-lead roles.*
Caucasian	Appears to be Caucasian
Visible minority	Not Caucasian

Table 2

***Definition of lead role:**

A person was coded as having the "lead role" of the photo if any, or a combination of the following behaviours were demonstrated:

- Used dominant body language (arms crossed, Making the body big, hands
- on hips) (Carney, Cuddy and Yap, 2010)
- Was pointing or directing another person to something
- Was the closest to the camera and looking at the camera (Mulvey, 1975)
- Appeared to hold a higher status position. Example, appear as a doctor and a nurse

FINDINGS

The coding process yielded interesting results and themes, which I will outline below. As already mentioned, I coded with the goal of establishing the existence and frequency of concepts within the data set. The main themes that I explored in my research are Theme 1: Frequency of females and males in STEM stock photography and Theme 2: Allocation of leadership roles amongst males and females in STEM photos. At the same time, during the research process I noticed another pervasive theme that I deemed important to incorporate as a late addition to my research. As explained in Theme 3 diversity in terms of race and ethnicity in stock photography is an issue that warrants further exploration.

Theme 1: Frequency of females and males in STEM stock photography

The first set of data coded relates to the Theme 1: Frequency of females and males in STEM photos. Of Theme 1's 600 photographs, I found that 51 photographs fell into the "CANNOT CODE" category and were not used in the calculated percentages (for further reference, see appendix). Through the lens of Media Effects, the 549 photographs that were coded produced significant results. More specifically, in the next section I will discuss STEM statistics versus the results I found in STEM stock photography.

The frequency of females and males represented in the data aligns with the gender gap in STEM. Overall, "Males Only" were present 51.5 percent of the time

compared to “Females Only” at 29.5 percent of the time. “Equal” gender representation occurred 11 percent of the time, “More Males than Females” at 6 percent of the time and “More Females then Males” 2 percent of the time (see fig. 10). When the frequency values are combined by gender (example, “Male Only” plus “More Males than Females”), I refer to the result as male-centric or female-centric. Overall, male-centric images were present 57 percent of the time, female-centric images were present 32 percent of the time and there was equal representation 11 percent of the time (see fig. 11).

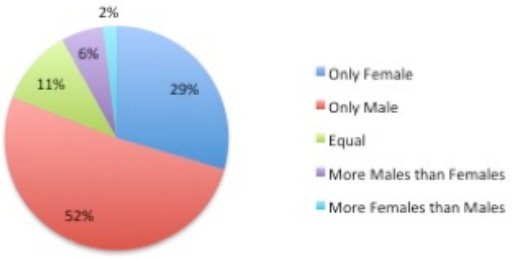

Fig. 10 Overall Results for Frequency

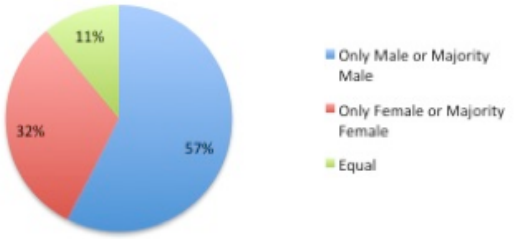

Fig. 11 Overall Frequencies Combined

When exploring the STEM fields individually, the results of this study also reflect the enrolment in the STEM field studies. A 2009 American Community Survey estimated that “well over half (57 percent) of female STEM majors study physical and life sciences, while fewer than one-third (31 percent) of men choose these fields” (Beede et al., 2011, p. 6). My results for the key word “Scientist” showed that 53 percent of the photos had “Females Only” while 23 percent were “Male Only” (see fig. 12) The male-centric and female-centric images were even closer to the survey’s findings, approximately 58 percent of the photos were

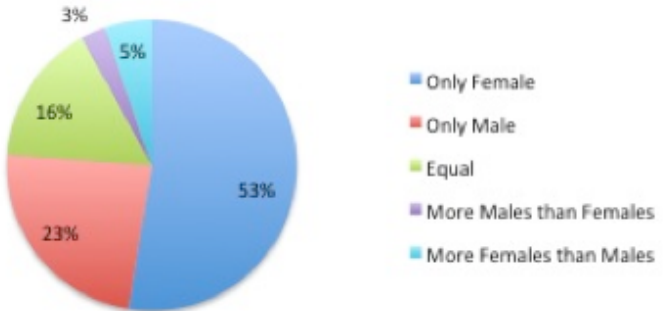

Fig. 12 “Scientist”

female-centric and 26 percent of the photos were male-centric.

The same study found that computer science and math occupations were comprised of 27 percent female workers (Beede et al., 2011). When I used “Computer Programmer” as a query, 85 percent of the results yielded only males and 9 percent only females (see fig. 13). When I used “Mathematician” as a query, 88 percent of the results yielded only males and 10 percent only females (see fig.14). Engineers Canada reported that females hold 10 percent of engineering licenses in Canada (Engineers Canada, 2009). My results echo that statistic by finding approximately 9 percent female-centric images using the keyword “Engineer” (see fig. 15).

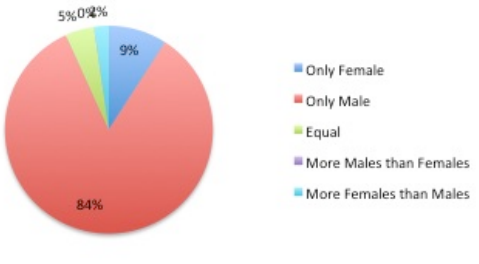

Fig. 13 “Computer Programmer”

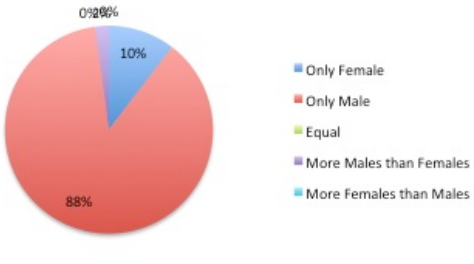

Fig. 14 “Mathematician”

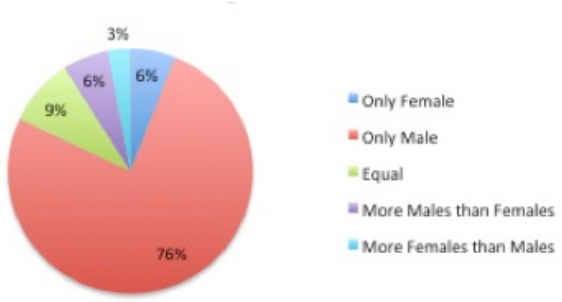

Fig. 15 “Engineer”

Theme 2: Allocation of leadership roles amongst males and females in STEM stock photography

Having established that females are under represented in STEM stock photography, it is also important to understand how they are represented. Determining whether a male or a female plays a lead role in any given stock photo is a useful way to begin to gain understanding about how females are being represented.

That being the case, the second set of data relates to the second theme, the allocation of leadership roles amongst males and females in STEM photos. Of the theme’s 200 photographs, I found that three photos held the value of “CANNOT CODE”; these were not used in the calculated percentages (for further reference, see appendix I). I noted that the second theme’s overall numbers were similar to the gender frequency numbers. In total, 58 percent of the “Lead roles” in the data set were held by males, almost double females who were portrayed as the “Lead role” in 30 percent of the data set (see fig.16).

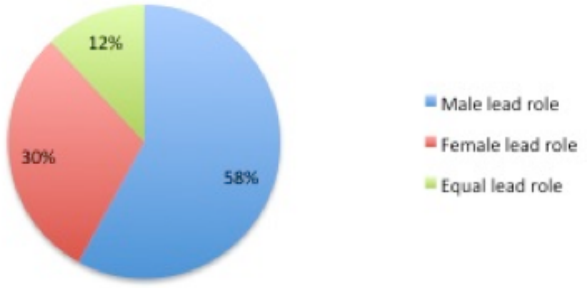

Fig. 16 Overall Lead Role

However, when the results were divided by STEM field, I noted significant discrepancies. Females in the math query were portrayed as the “lead role” 46 percent of time (see fig. 17), whereas females in the computer programmer query were portrayed as the lead role 16 percent of the time, a 40 percent difference. However the math query was an exception, males portrayed as the lead role across other STEM fields were similar, 58 percent for science, 56 percent for engineer and 57 percent for computer programmer (see fig. 18, 19, and 20).

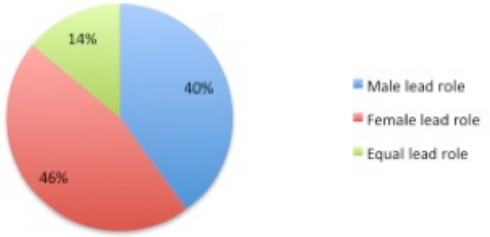

Fig. 17 “Male and Female Math”

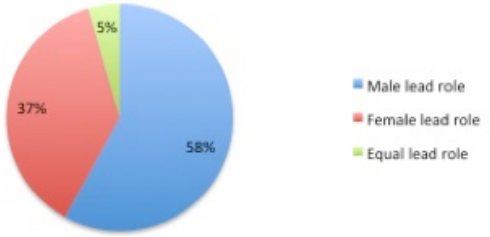

Fig. 18 “Male and Female Scientist”

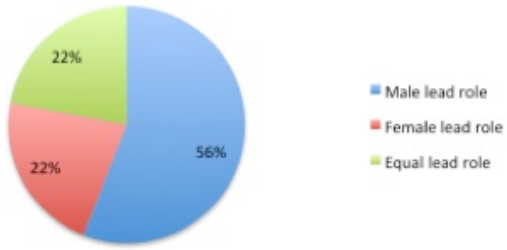

Fig. 19 “Male and Female Engineer”

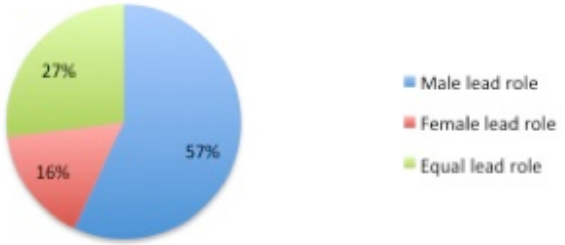

Fig. 20 “Male and Female Computer Programmer”

The overall results indicate that males generally hold the lead position or leadership role in the data set's photographs. This result is especially salient given that women with STEM careers routinely leave their work prior to retirement due to their being paid less and feel trivialized and / or unheard (Alphonso, 2014). is the subservient role of females in STEM stock photography is also notable insofar as a recent survey of young females (7-21 years old) found that women being under-represented in leadership roles can have discouraging consequences on young women, "just over half" of whom are "to some extent put off, feeling that they have less chance of succeeding themselves (54%), with almost one in three feeling this quite strongly (29%)" (Girlguiding, 2013, p. 18).

Theme 3: What about race?

Initially, issues of race and ethnicity were not considered in this research project. However, as I proceeded to develop and engage in the coding process I noted that there were an overwhelming preponderance of Caucasian models of both sexes and very few other races or ethnicities represented. Since, as Busch et al. suggest, it is important to keep the number of concepts relatively flexible in case a major theme or issue is present in the text and should be accounted for (2012) I decided, as a late addition to this research, to include Ethnicity as a variable and to code the photos from the first data set using "Caucasian" and "Visible Minority" as values (see tables 1 and 2). In so doing, 39 of the 600 photos were identified

as “CANNOT CODE” and were not included in the calculations. Nonetheless, the results were considerable with 90 percent of the models featured in the photographs being Caucasian while only 10 percent of the models represented being non-Caucasian (see fig. 20).

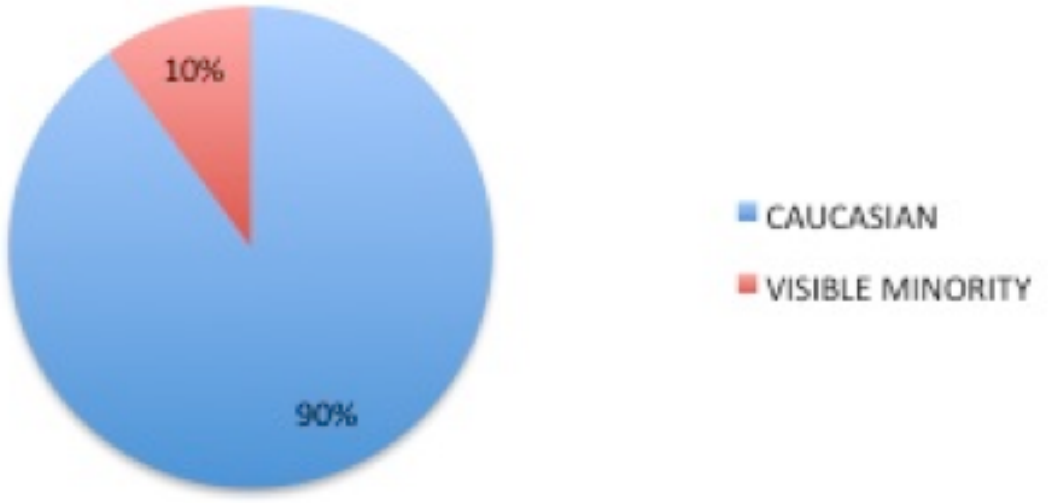

Fig. 20 Overall Visible Minority and Caucasian

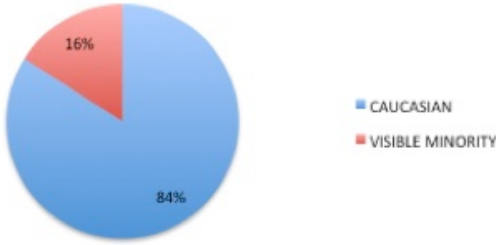

Fig. 21 “Engineering” Visible Minority and Caucasian

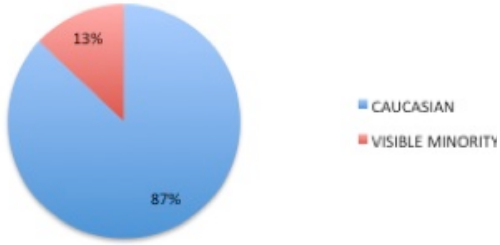

Fig. 22 “Science” Visible Minority and Caucasian

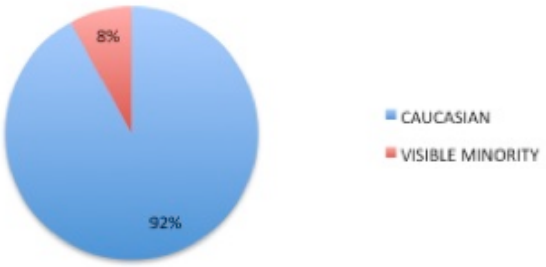

Fig. 23 “Technology” Visible Minority and Caucasian

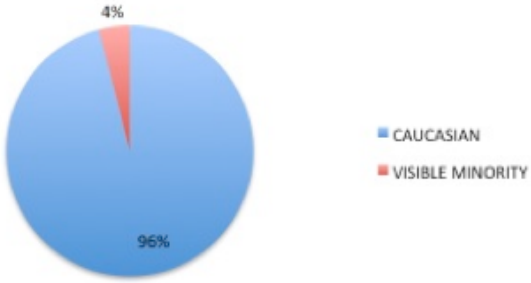

Fig. 24 “Technology” Visible Minority and Caucasian

The engineering photos in the data set were, comparatively, the most diverse at 16 percent visible minority representation and 84 percent Caucasian. The least diverse of the data set was math with 4 percent featuring visible minority photos while 96 percent were Caucasian. A Media Effects analysis might understand these results as promoting a “perceived reality.”

The racialization of STEM fields in stock photography is also significant since, unlike the gender gap, STEM fields are actually quite diverse in terms of ethnicity. For example, although Canadian statistics were not available the U.S. Department of Commerce notes that “about 41 percent of Asians with a science or engineering degree are currently employed in a STEM occupation, followed by individuals who self-identify as Two or More Races (24 percent) and non-Hispanic White (23 percent)” (Landiver, 2013, p. 2). So while the focus of and impetus for this research project is on gender issues, this racialized dimension of STEM-centric stock photography is a significant discovery that would merit further study.

DISCUSSION, LIMITATIONS AND CONSIDERATIONS

Media Effects

Media Effects theories often use content analysis as a methodology because Media Effects research routinely studies large data sets to identify concepts and correlations while content analysis is ideal for revealing patterns and themes in large amounts of information. Media Effects sometimes examines the audience's opinion and understanding of an issue in relation to how it was been framed or promoted in the media. However, many Media Effects studies only look at the production side of the media. My research study explored the production side of stock photography and did not study the audience reception of stock photography. This section will discuss my findings in a Media Effects context, limitations to the study and additional considerations related to this research.

Findings from a Media Effects Perspective

As discussed, I found that the frequency of males and females in the data set mirror North American statistics regarding gender distribution in STEM fields. Given the pervasive nature of stock photography and the influential power of imagery, a Media Effects perpective could lead to an understanding of my results as a contribution to or a reinforcement of the gender gap in STEM. George Gerbner's Cultivation Theory suggests that the higher the exposure to a stereotype or idea, the more likely the viewer will perceive that stereotype as

reality (Gerbner, 1998). Although Cultivation Theory was developed through studying violence on television, its fundamental insights can be applied to themes in commercial stock photography.

Through the lens of Cultivation Theory, if an audience repeatedly sees an overwhelming majority of males represented in STEM promotion, Gerbner would argue that the audience would develop an understanding of STEM fields as largely male dominated. Gerbner also discusses the media's ability to promote hegemonic ideals through its outlets (1998). In this study, the under representation of females in popular STEM photography could be regarded as contributing to a hegemonic, patriarchal agenda. Gerbner notes that when an audience member sees their "cultivated reality" in real life, the audience member experiences "resonance" and the cultivation grows deeper (Gerber, 1998). For example, in the case of STEM stock photography, if a person is repeatedly exposed to male-centric STEM imagery in the media and has an uncle who is an engineer, according to "resonance" and Cultivation Theory, that person is much more likely to believe that females don't participate in engineering.

In terms of Framing Theory, the findings of my research indicate that STEM disciplines (in the data I looked at) are framed as male-led, male-centric, Caucasian career choices. Looking at gender, I found that 52 percent of the photos in my data set were male-centric while 29 percent were female-centric. Moreover, almost 60 percent of the time, males were framed as the dominant

subject in the photograph while females were framed as the dominant subject 30 percent of the time. My data set reveals that popular STEM photos are framing STEM careers as male-centric and male-led, thus reproducing social norms that align with the gender gap.

Taking ethnic diversity into consideration, my data set indicated that 90 percent of the photos featured Caucasian models while only 10 percent featured visible minorities. More specifically, in math fields my sample indicated that 92 percent of the photos featured Caucasian only models. These stock photos, then, are missing the ethnic diversity of, for example, Canada's population and the STEM workforce.

My limited findings regarding visible minorities indicate that there may be some important underlying issues and biases in stock photography and since approximately 70 percent of the imagery society consumes through advertising is stock photography, it is important to further research the issue of race in stock photography.

Intersectionality

One major limitation to content analysis is that it can lack context and in-depth knowledge of a subject or theme (Busch et al., 2012). For exmpale, in this study I did not explore how these photos are interpreted by the audience. Every individual comes from their own, unique background that shapes how they see

and how they consume media. Generally, Media Effects theories are also lacking in in-depth focus on individual interpretations, instead regarding the audience as a sub-group or a mass (Bryant et al., 2012). Intersectionality is a theoretical perspective that may help provide a more in-depth interpretation of STEM photos.

Intersectionality is a recent concept developed within a feminist framework that emphasizes social location instead of one characteristic (Shields, 2008). More specifically, gender must be understood in the context of power relations embedded in social identities (Collins 1990; 2000). Working from an Intersectionality standpoint, both race and gender would be included and possibly emphasized. However, Intersectionality studies are heavily reliant on in-depth, qualitative research. Intersectionality tends to view power structures as somewhat homogenized but individuals as completely unique. Interestingly, Media Effects theories work the other way. Media Effects theories (especially the early theories) by and large regard the audience as one group where each member is affected the same way. That being the case, bring Intersectionality research to bear on this research – gender and STEM stock photography – might add further texture to research on the audiences of stock photography. Despite their different backgrounds it might be useful to "intersect" Media Effects and content analysis concepts with Intersectionality research in order to extend this research. For example, a study could be conducted with three

different people's understanding of the gender gap in STEM. The research would have to probe the structure of media consumed by the subjects, along with the subjects' interpretation and the specific socialization and life events of the subjects. Results from such a study could produce greater detail and be helpful in understanding how information is framed and consumed in and across different subcultures and individuals.

Life of a Photo

Another limitation to studying stock photography is the inherent uncertainty about the photo's circulation and exposure. Although there is a likelihood that the photos used in my data set and findings were disseminated as promotional material, there is no way to track or verify the how and where the photos in my data set were or are being used. Stock photography sites are considered "brokers" of photography and are not actually selling a final advertisement, akin to flour to a bakery. When the photo is purchased and circulated, it could be used in many different ways that may contradict the message of the raw photo. Dr. Paul Martin Lester, for example, discusses the importance of how an image changes when words are assigned to it (Lester, 2006). This study only looked at raw photos that hadn't been placed in advertising or marketing material. Therefore, it is important to note that when the popular photos are purchased their meaning may change before an audience consumes it. Moreover, there was

no indication whether the photos in the data set were downloaded and used only once, or whether they were printed in hundreds of thousands of newspapers. Thus, it is difficult to gauge the audience reaction and circulation of the photos in the data set. Since there is no data to track how much exposure each photo has, it limits the study to only “the most downloaded” or the “most popular” photographs, as determined by Fotolia and iStock.

Shift in Photography

It is also important to discuss the ways photography has and continues to change as a limitation and additional consideration for my research. As interactive technology, connectivity and mobile devices have become an essential part of the lives of North Americans, so has photography. In 2006 there were 53 billion digital photos taken and the average American took 177 photographs (Vartanian, 2012). In 2011, as mobile device usage increased, 80 billion photos were taken and the average American took 255 digital photographs and these numbers are expected to increase; by 2015 National Geographic projects that 105 billion digital photos will be taken (Vartanian, 2012). Mobile photo-sharing applications like Facebook, Snapchat, Instagram, and the recent “selfie” phenomenon are said to be the major influencers that have increased photo taking (Vartanian, 2012). As the number of user-generated photos increases, the number of commercial photographs stays relatively stable but is shrinking relative to

photography in general. Thus, audiences may eventually be consuming many more user-generated photos than stock photographs. Therefore, a study focused on STEM-centric photographs that are user generated could be appropriate in order to understand how STEM fields are visually understood (see fig. 25 and 26 as user-generated examples). Significantly, once user-generated photos become the object of study, there are major differences in terms of Media Effects. The "gatekeepers," for example, are no longer major corporations but individuals, friends and family. Moreover, audiences are, for the most part, much smaller and direct the photographs' meaning; the audience, for example, knows the photographer and therefore has a much better understanding of the context of the photo. Given the overwhelming increase in user-generated photography and the substantial power photos have, there are many opportunities for future research regarding STEM and user-generated photos. This is another limitation of this project's methodology. If young women are viewing more user-generated

Fig. 25 "Science Selfie" Source: http://scontent-b.cdninstagram.com/hphotos-xap1/t51.2885-15/10546779_519361208195231_1960775511_a.jpg

Fig. 26 "Science Selfie 2" Source: http://33.media.tumblr.com/tumblr_mahic4owxO1rtkq5co1_500.jpg

photographs and have the power to produce their own, their media consumption is drastically different from a one-way, mass media, communication model.

Algorithms, key words and tags

Another limitation in my research is related to the use of keywords. When gathering the photos I had to assume that photo purchasers would search for words like “engineer” or “male and female engineer” if they were looking for an engineer photograph with a human subject. However, that is only an assumption and it has to be noted that each photo purchaser may have different approaches when it comes to searching for photos. Like most websites that house a lot of content, stock photography sites have advanced search tools and algorithms that help customers navigate their interfaces. Moreover, stock photography sites use a

Fig. 27 Female Engineer with Keywords Source: Fotolia.com

customized set of keywords to tag every photo on their site. For example, Fig. 27 is shown with all the keywords (alone and in any combination) that will pull up the photo for display.

The words used here have been decided on and/or approved by Fotolia. From a Media Effects perspective Fotolia is exercising its power as a "gatekeeper" when they determine what this photo is and what keywords correspond to it. We are being told, for instance, what "African" looks like, or what "beautiful" and "success" look like. I find this highly problematic as it leaves little room for open or iterative interpretations. Indeed, it seems unethical that only a few people working for a large corporation get to choose what engineering looks like and what it doesn't. A more democratic tagging system might help alleviate some of the corporate value creation. For example, an open-edit format such as Wikipedia might be useful in creating a new style of tagging system for stock photography. I am confident that this style of tagging system would also initiate a lot of interesting conversation and dialogue about thematic and visual judgment and interpretation.

Global Perspective

An additional area related to this research that merits further exploration is the impact of STEM marketing across the globe. In September 2013, the McKinsey & Company research group released a study that addressed women in STEM fields

across the globe. They explored high-achieving females' post-secondary subject choices at top universities. They found that in the United States, 4 percent of high-achieving females chose to study STEM while in India "57 percent of high-performing women study STEM subjects. In Morocco, it's 37 percent and in Turkey 25 percent" (Jaffar and Mourshed, 2013, p. 1). In India for example, women's rights are entirely different than they are in the United States. In India "discrimination against girls starts at home. In a majority of households boys are given preferential treatment in terms of education, facilities, and mobility. Very few girls gain the liberty to plan their own life. Their activities are controlled. This discrimination within the family breeds violence across society against women. Any violation of social norms is treated with contempt" (Kumar, 2014, p. 10). If women are less valued in India and have fewer rights, why are there far more high-performing women in STEM than there are in the United States? One approach that I have considered is a comparative analysis of the promotional material (including photography) used for STEM in India versus North America. How is STEM framed in India? Do post-secondary institutions use stock photography in India? From the preliminary research I have been able to conduct on this topic, I found that there are several universities dedicated solely to STEM subjects in India. The top seven universities in India have the word "technology" explicitly in their name, a telling sign that STEM is being prioritized (QS, 2013). But seeking information about how STEM is marketed in India proved to be quite

difficult. After repeated, unsuccessful attempts to reach out to Women in Science and Engineering India (WISE) and various other Indian universities, I began to realize that the issue is far too large to garner an accurate interpretation of how STEM is perceived. The marketing and advertising of STEM is only a small component that contributes to the understanding and attitudes toward the fields. Moreover, from an Intersectionality perspective, I would have to understand far more about Indian culture, and the specific women in the study. Nonetheless, McKinsey's results were intriguing and warrant further investigation.

CONCLUSION

The gender gap in STEM is an issue that has been examined by a broad range of disciplines. Although the directly related subjects are well known (Science, Engineering, Technology and Math), researchers in Psychology, Labour Studies, Sociology, Commerce, Education Studies and Professional Communication all understand the issue in a different light and from different perspectives. My research for this paper has primarily touched on the relationship of STEM fields and gender to visual communication, media studies and marketing. Establishing the trends and themes explored in relation to the gender gap, Media Effects, visual culture and the stock photography industry informed my research and enabled me to create research questions that probed the marketing of STEM subjects and careers.

When I applied the research questions to my data set, the results were almost parallel to the statistics regarding gender distribution in the STEM industries. In this respect, my results could be understood as the stock photography industry accurate reflecting the gender distribution of the STEM fields. However, given the power these companies can have over culture creation, it is concerning that they are not socially conscious enough to deliver a variety of photos that can positively contribute to gender equality in STEM fields. Instead, the dominant stock photography companies are avoiding challenging photos that promote equality by visually perpetuating gender stereotypes.

The purpose of this research is not to draw causal connections between the misrepresentation of females in STEM stock photography and the gender gap in STEM fields and areas of study. However, from the perspective of Media Effects theories it could be assumed that stock photography does contribute to a much larger body of visual media content that can – and indeed does – create impressions and in turn, influence behaviour.

On a more optimistic note, companies like Shestock (shestockimages.com) – which I had the opportunity to visit this summer (2014) – have created a promising and fresh approach to the business of stock photography. Shestock's mission statement is as follows:

> Shestock is compelling and visceral female-centric images created exclusively by professional women photographers. Our mission is to provide insightful and inspired visions of the real lives of real women. Our images help repair a long-broken dialog between marketers and the women they are trying to reach. We believe it is possible to simultaneously satisfy the needs of buyers, women, and our talented artists by offering only images that help bridge the connection between each. (Shestock, 2014)

I am hopeful that this business model will gain traction in the advertising industry over the next few years. As large companies are becoming more transparent and as they strive to appear more ethically responsible, socially conscious services and products that companies like Shestock provide will be in higher demand.

The findings of this study illustrate not only the issues that Shestock is hoping to overcome, but they also align with the goals of many post-secondary

education institutions across Canada. The driving force for Shestock and Ryerson's *Hydro One Women in Engineering University Partnership* is to fairly and comprehensively understand and represent females. More equitable depictions and representations of women, when applied to stock photography, has the potential to contribute to world of stock photographs that are inspiring and relatable and that promote a visual culture featuring more progressive promotional material.

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Appendix A: Coding Schedules

"Computer Programmer" (Fotolia)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than males
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“Female Computer Programmer” (Fotolia)

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Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
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“Computer Programmer Female” (iStock)

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“Computer Programmer Male” (iStock)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
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“Engineer” (Fotolia)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
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“Engineer Male” (iStock)

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Lead Role Engineer (Fotolia)

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Lead Role Engineer (iStock)

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“Math” (Fotolia)

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“Scientist” (Fotolia)

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“Female Scientist” (Fotolia)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
1					
			1		
1					
1					
1					
1					
				1	
			1		
1					
1					
	1				
1					
1					
1					
	1				
1					
				1	
		1			
1					
			1		
1					
1					
1					
1					
			1		

Caucasian	Visible Minority	CANNOT CODE
	1	
1		
	1	
1		
1		
1		
1		
1		
1		
1		
1		
1		
		1
1		
1		
	1	
1		
1		
1		
1		
1		
1		
1		
1		
1		

“Male Scientist” (Fotolia)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
			1		
	1				
			1		
			1		
	1				
	1				
			1		
				1	
	1				
			1		

1		
		1
1		
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1		
		1
		1
1		
	1	
		1
		1
		1
		1
		1
	1	

Caucasian	Visible Minority	CANNOT CODE
1		
1		
1		
		1
1		
1		
1		
		1
1		
1		
1		
1		
1		
1		
		1
1		
1		
1		
1		
		1
1		
1		

1	
1	
1	

“Female Scientist” (iStock)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
1					
1					
1					
1					
1					
1					
		1			
1					
1					
1					
1					
1					
					1
1					
1					
1					
			1		
1					
1					
1					
1					
1					
1					
			1		
1					

Caucasian	Visible Minority	CANNOT CODE
1		
1		
1		
		1
1		

1					
		1			
1					
1					
1					
1					
1					
1					
1					
1					
1					
1					
1					
1					
1					
		1			
1					
1					
1					

“Male Scientist” (iStock)

Only Female	Only Male	Undetermined	Equal	More Males than Females	More Females than Males
	1				
	1				
		1			
	1				
					1
	1				
			1		
	1				
	1				
	1				
		1			
			1		
	1				
	1				
		1			
					1

1		
	1	
	1	
1		
1		
1		
1		
1		
1		

Caucasian	Visible Minority	CANNOT CODE
1		
1		
1		
		1
1		
1		
1		
1		
1		
1		
1		
1		
1		
1		
1		
	1	
1		
1		
1		
1		
1		
1		
1		
1		
1		
1		

Lead Role Scientist

ISTOCK SCIENTIST MALE LR	ISTOCK SCIENTIST FEMALE LR	ISTOCK SCIENTIST EQUAL	ISTOCKSCIENTIST	CANNOT CODE
			1	1
	1			
1				
1				
		1		
1		1		
1				
1				
1				
1				
			1	
	1			
	1			
	1			
1				
1				
1				
				1
1				
	1			
1				
1				
1				
1				
1		2		

FOTOLIA SCIENTIST MALE LR	FOTOLIA SCIENTIST FEMALE LR	FOTOLIA SCIENTIST EQUAL	FOTOLIA SCIENTIST CANNOT CODE
1			
	1		
	1		
	1		
1			
1			
	1		
		1	
1			
	1		
	1		
	1		
1			
1			
1			
1			
	1		
	1		
1			
		1	
1			

	1
1	
	1
1	

LEAD ROLE SUMMARY TABLE

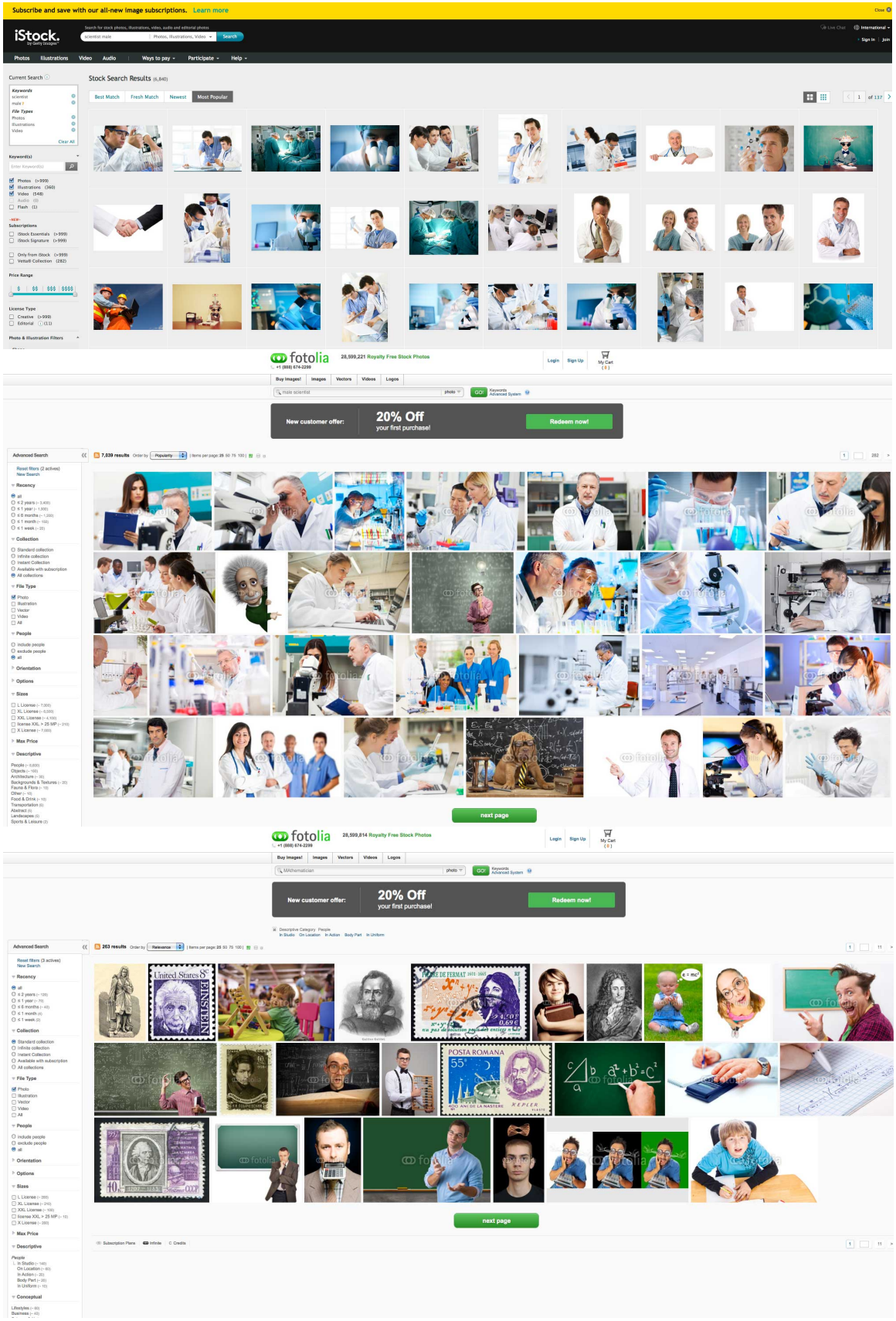
FOTOLIA ENG MALE LR	FOTOLIA ENG FEMALE LR	FOTOLIA ENG EQUAL	FOTOLIA ENG CANNOT CODE
15	5	5	0
ISTOCK ENG MALE LR	ISTOCK ENG FEMALE LR	ISTOCK ENG EQUAL	ISTOCK ENG CANNOT CODE
13	6	6	0
TOTAL:			
28	11	11	0
56	22	22	
FOTOLIA SCIENTIST MALE LR	FOTOLIA SCIENTIST FEMALE LR	FOTOLIA SCIENTIST EQUAL	FOTOLIA SCIENTIST CANNOT CODE
12	13	2	0
ISTOCK SCIENTIST MALE LR	ISTOCK SCIENTIST FEMALE LR	ISTOCK SCIENTIST EQUAL	ISTOCKSCIENTIST CANNOT CODE
16	5	2	2
28	18	4	2
58	37.5	4.5	
FOTOLIA CP MALE LR	FOTOLIA CP FEMALE LR	FOTOLIA CP EQUAL	FOTOLIA CP CANNOT CODE
14	3	8	0
ISTOCK CP MALE LR	ISTOCK CP FEMALE LR	ISTOCK CP EQUAL	ISTOCK CP CANNOT CODE
14	5	5	1
28	8	13	1
57	16	27	
FOTOLIA MATH MALE LR	FOTOLIA MATH FEMALE LR	FOTOLIA MATH EQUAL	FOTOLIA MATH CANNOT CODE
12	11	2	0
ISTOCK MATH MALE LR	ISTOCK ENG MATH FEMALE LR	ISTOCK ENG MATH EQUAL	ISTOCK ENG MATH CANNOT CODE
8	12	5	0
20	23	7	0

40	46	14	
30	11	11	3
28	18	4	
28	8	13	
28	23	7	
114	60	35	
58%	30%	12%	

FREQUENCY SUMMARY TABLE

Only Female	Only Male	CANNOT CODE	Equal	More Men than Women	More women than men	# of photos Coded total	CAUC ASIAN	VISIBLE MINORITY	CANNOT CODE
2	16	5	1	1	0		18	1	6
0	10	11	2	1	1		15	1	9
2/5.8%	26/76%	16	3/8.8%	2/5.8%	1/2.9%	34	33	2	15
10	0	2	7	3	3		20	5	0
4	2	2	10	7	0		18	5	2
14/30%	2/4.3%	4	17/37%	10/22%	3/6.5%	46	38	10	2
0	22	1	1	1	0		20	5	0
0	17	1	4	3	0		21	4	0
0	39/81.3%	2	5/10.4%	4/8.3%	0	48	41	9	0
14-07-12	Only Male	CANNOT CODE	Equal	More Men than Women	More women than men		CAUC ASIAN	VISIBLE MINORITY	CANNOT CODE
11	6	4	2	1	1		18	2	5
9	3	8	4	0	1		15	6	4
20/52.6%	9/23.6	12	6/15.7	1/2.6%	2/5.3%	38	33	8	9
21	0	1	2	1	0		23	2	0
16	2	1	4	2	0		20	4	1
37/77%	2/4.2%	2	6/12.5	3/6.25%	0	48	43	6	1
0	16	3	4	0	2		24	0	1
0	10	2	10	3	0		20	4	1

0	26/58 %	5	14/31%	3/6.7%	2/4.4%	45	44	4	2
Only Female	Only Male	CANNOT CODE	Equal	More Men than Women	More women than men		CAUC ASIAN	VISIBLE MINORITY	CANNOT CODE
4	20	0	0	1	0		24	1	0
1	22	2	0	0	0		24	1	0
5/10.4 %	42/87 .5%	2	0	1/2.1%	0	48	48	2	0
16	0	1	1	7	0		24	1	0
21	3	1	0	0	0		25	0	0
37/77 %	3/6.25%	2	1/2.1%	7/14.45	0	48	49	1	0
0	24	0	1	0	0		23	2	0
0	25	0	0	0	0		24	1	0
0	49/98 %	0	1/2 %	0	0	50	47	3	0
Only Female	Only Male	CANNOT CODE	Equal	More Men than Women	More women than men		CAUC ASIAN	VISIBLE MINORITY	CANNOT CODE
1	17	6	1	0	0		18	1	6
3	20	0	1	0	1		22	2	1
4/9.1%	37/84 .1%	6	2/4.5%	0	1/2.27%	44	40	3	7
25	0	0	0	0	0		24	1	0
18	0	0	5	2	0		21	4	0
43/86 %	0	0	5/10 %	2/4%	0	0	45	5	0
0	25	0	0	0	0		22	2	1
0	23	0	2	0	0		22	1	2
0	48/96 %	0	2/4 %	0	0	0	44	3	3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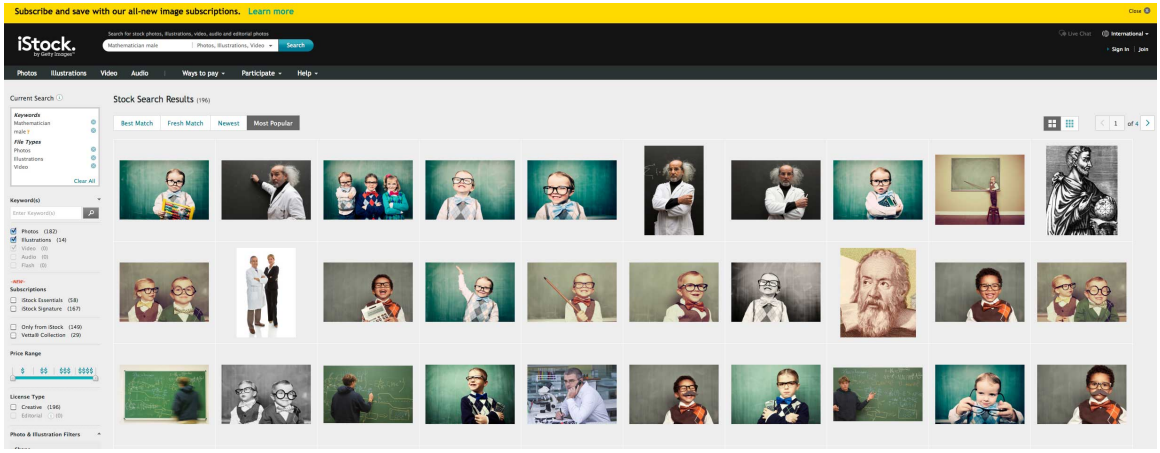
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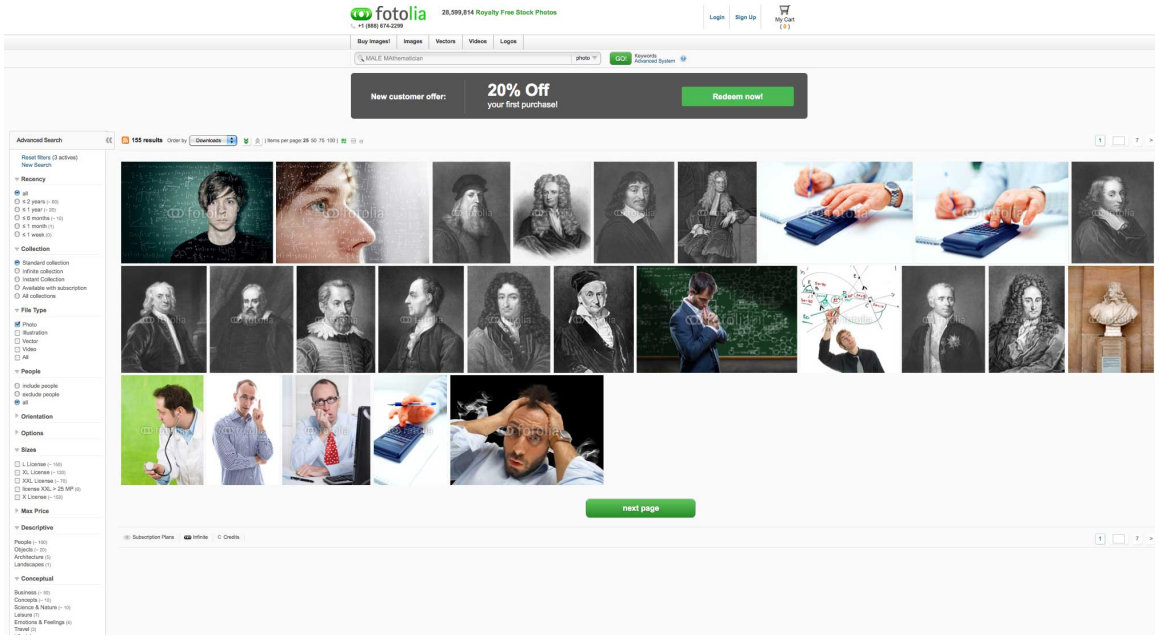
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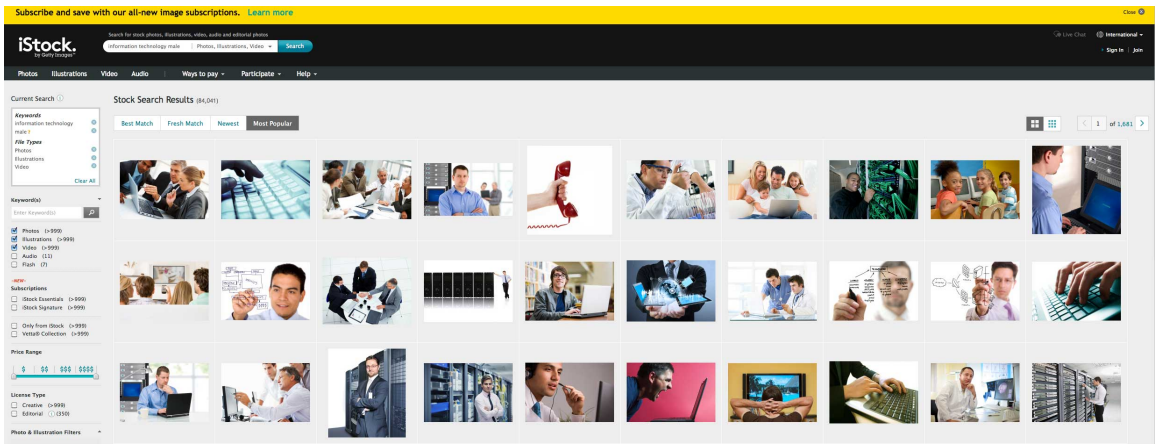
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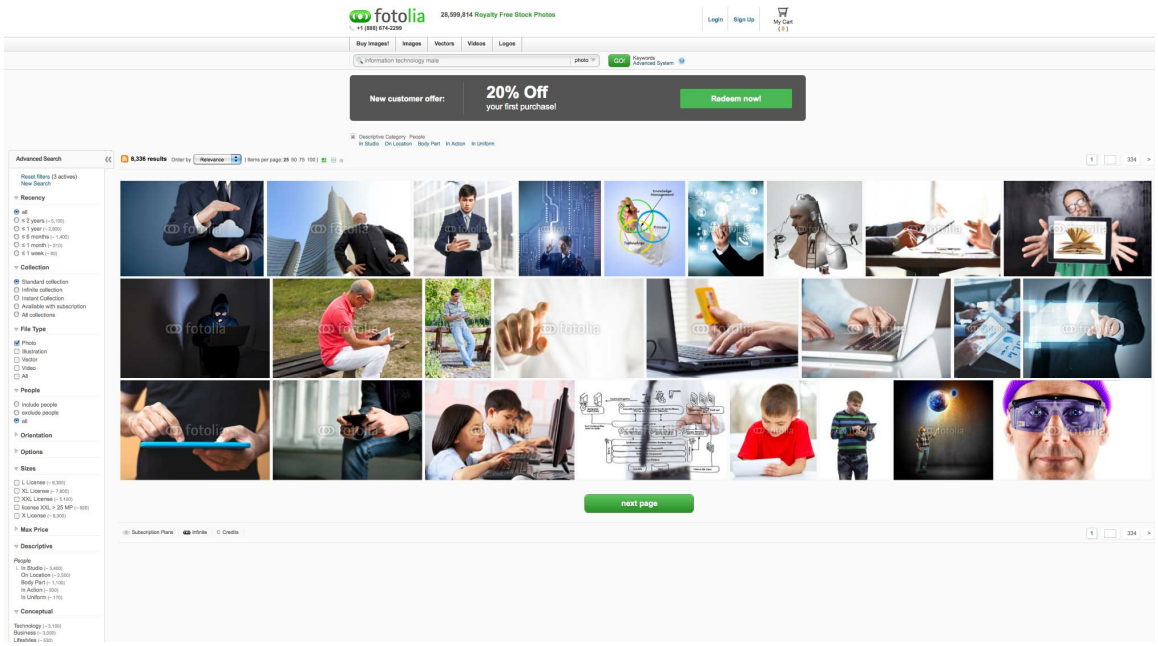
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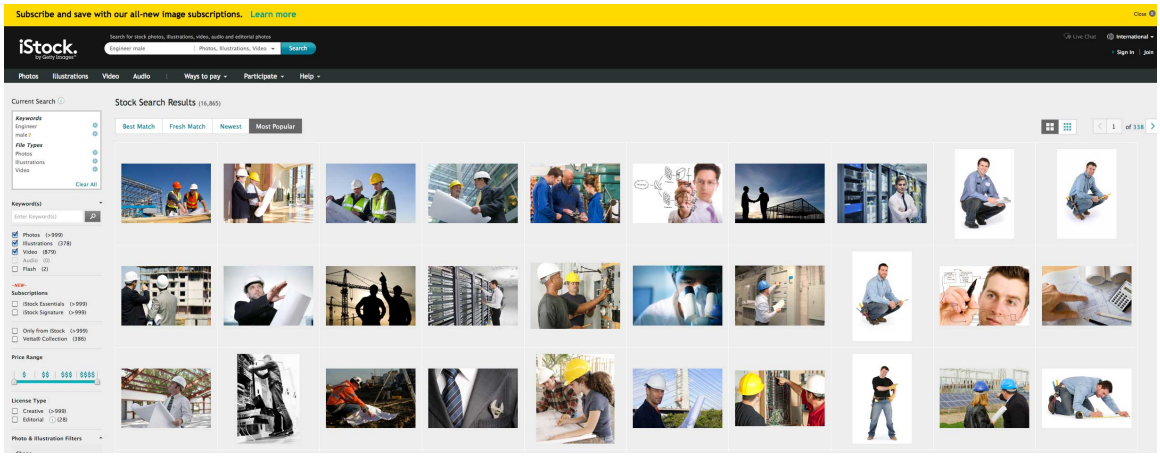
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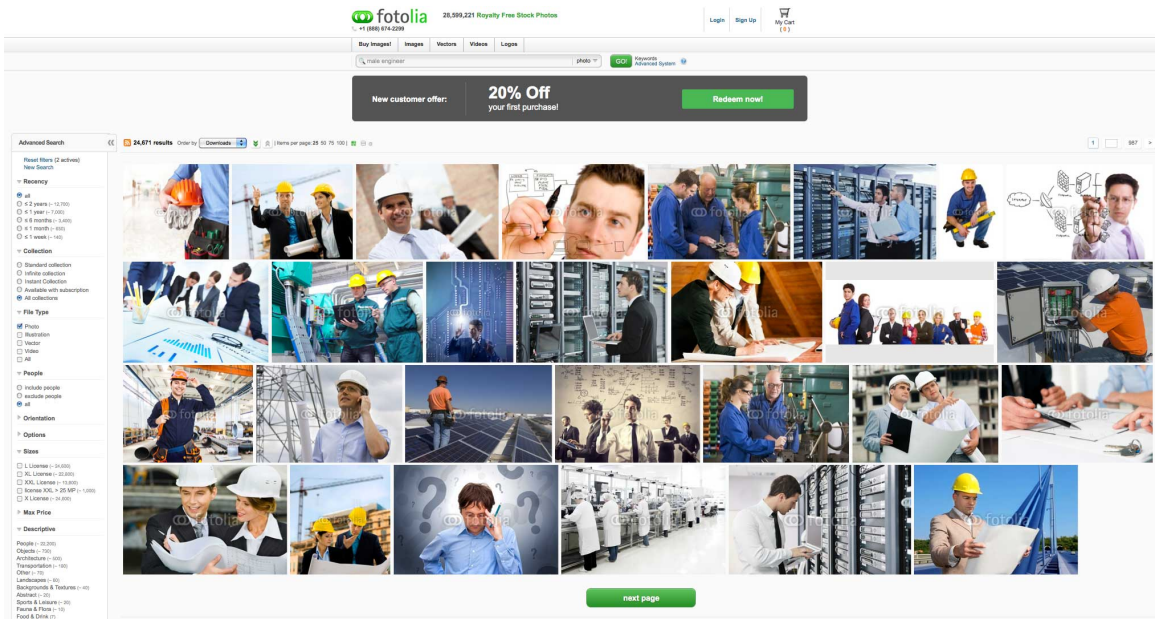
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GO!
Keywords
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24,671 results
Order by
Downloads
Relevance
Items per page: 25 50 75 100
Reset filters (2 actives)
New Search
Recency
Collection
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Orientation
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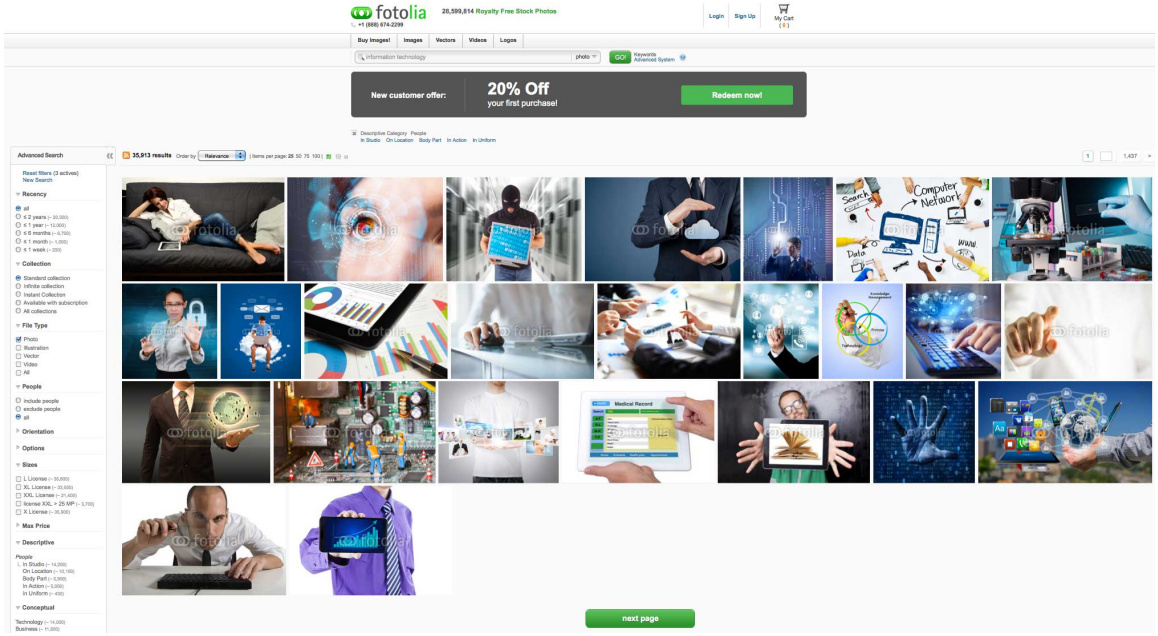
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In Action
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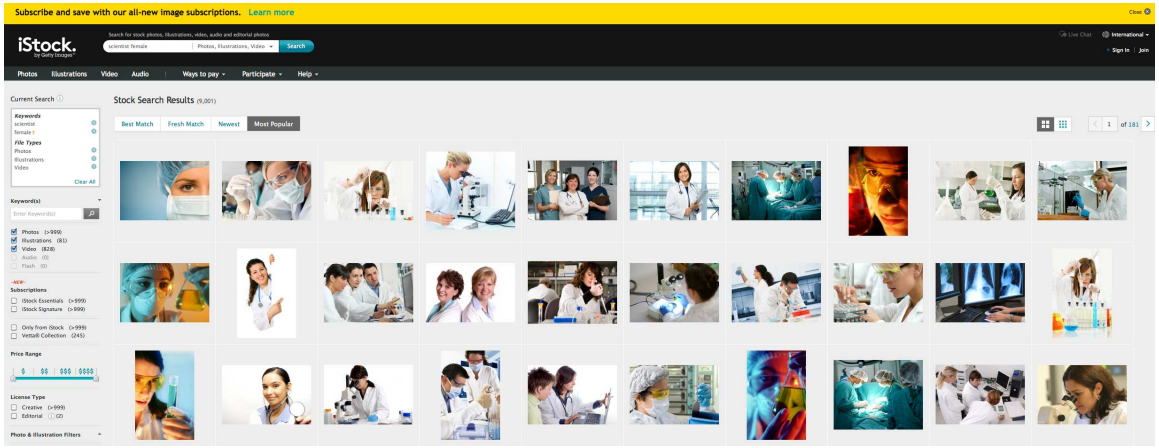
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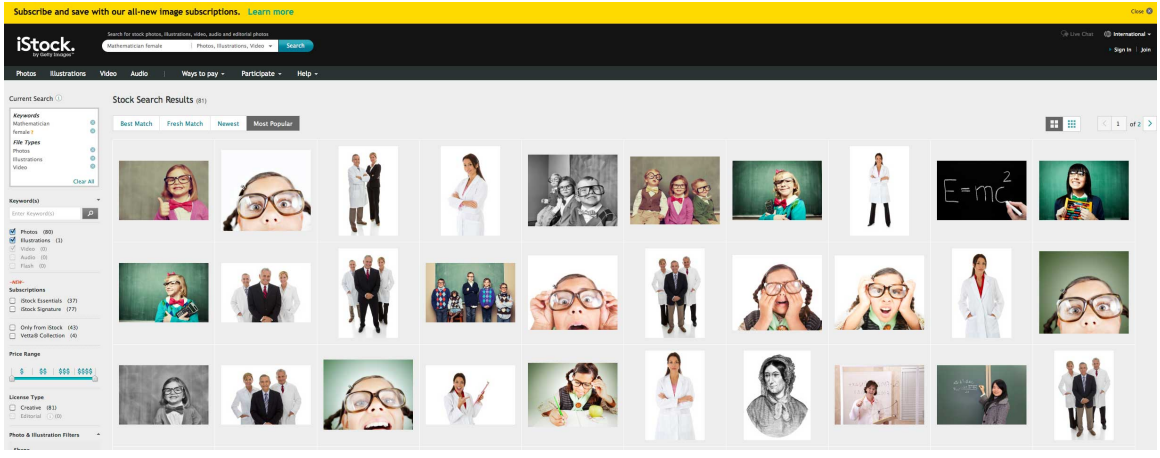
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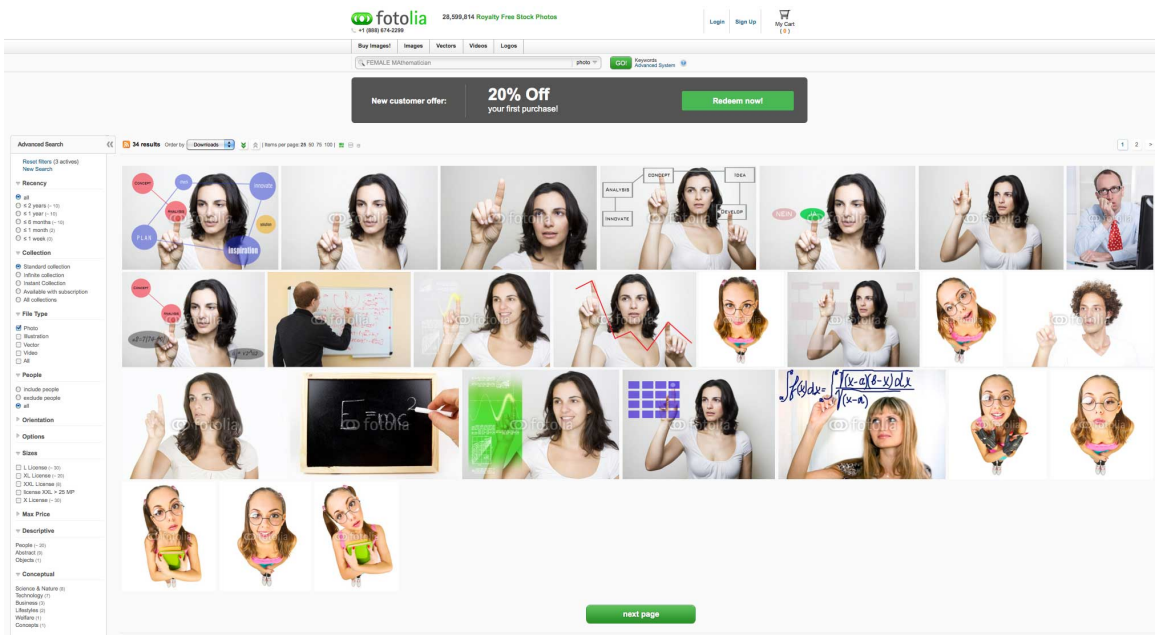
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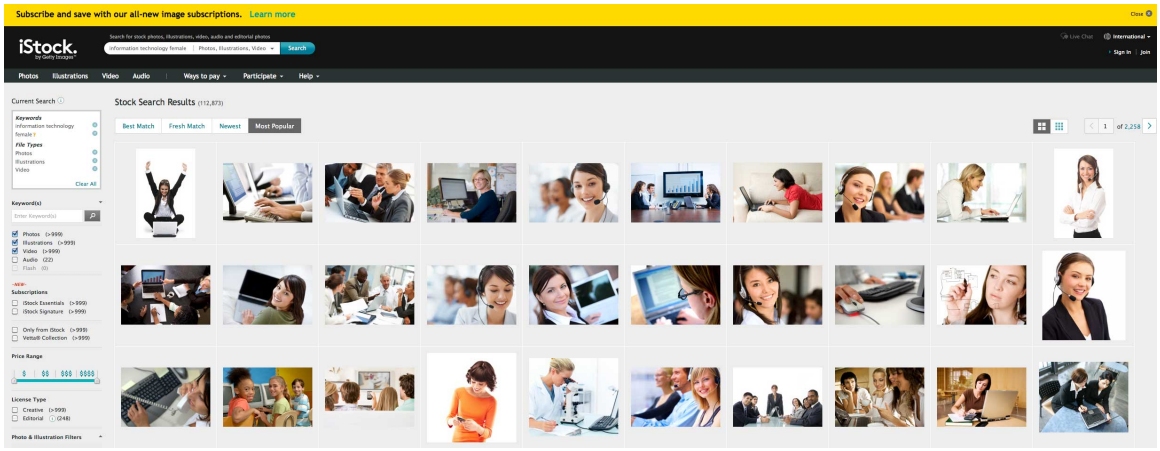
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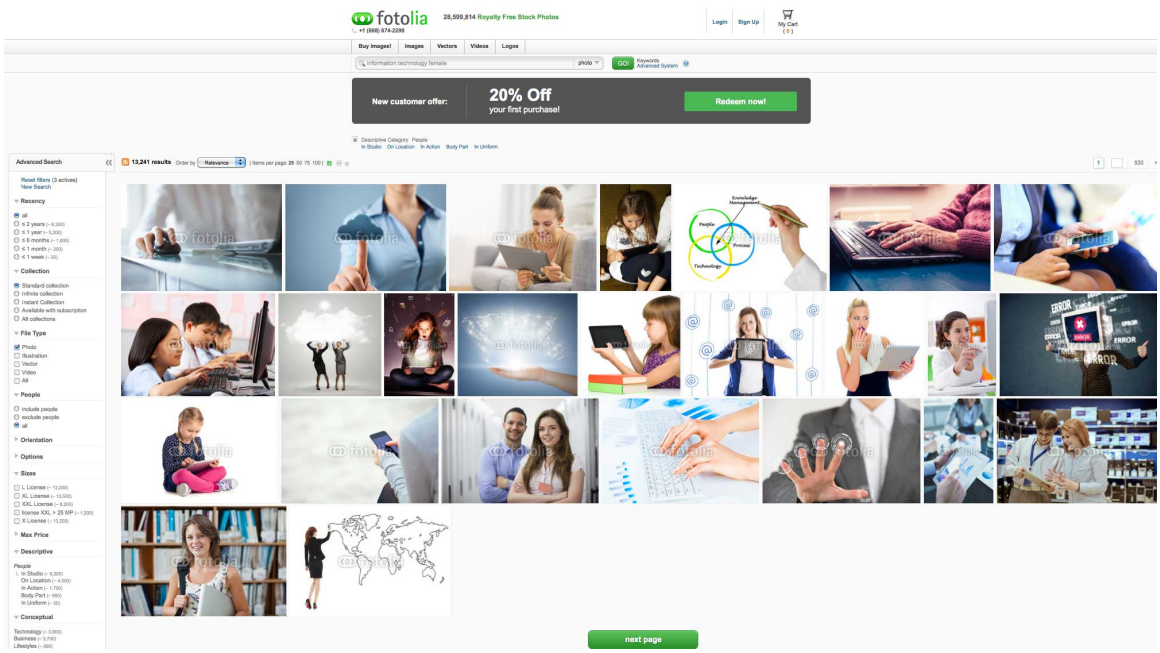
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Items per page: 25 50 75 100
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Collection
File Type
People
Orientation
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Sizes
Max Price
Descriptive
Conceptual
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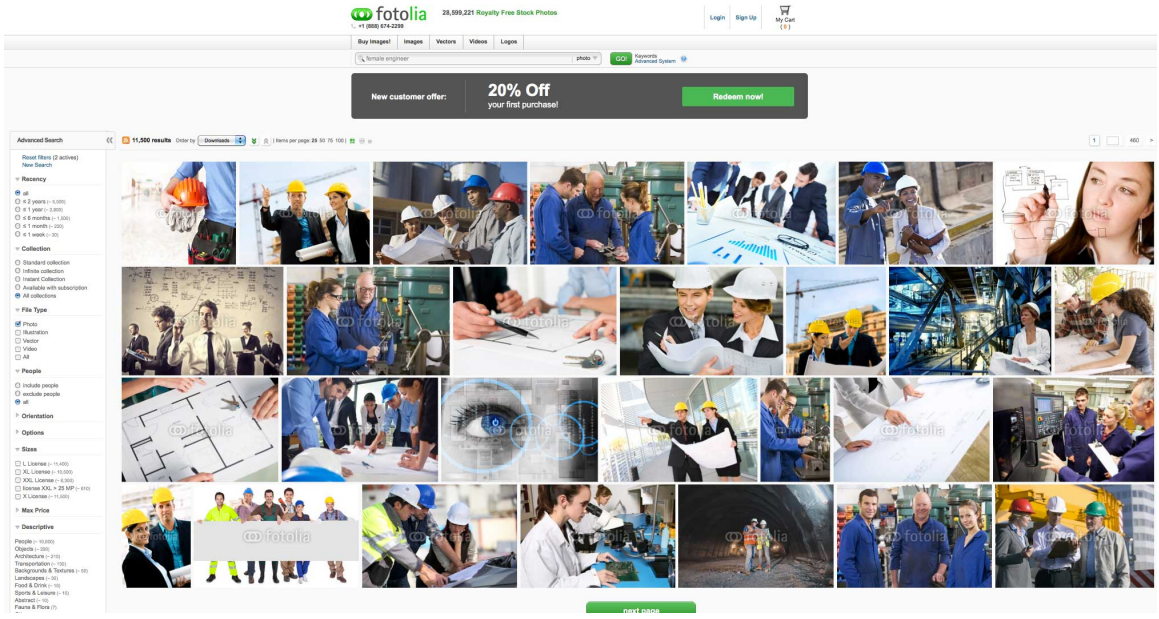
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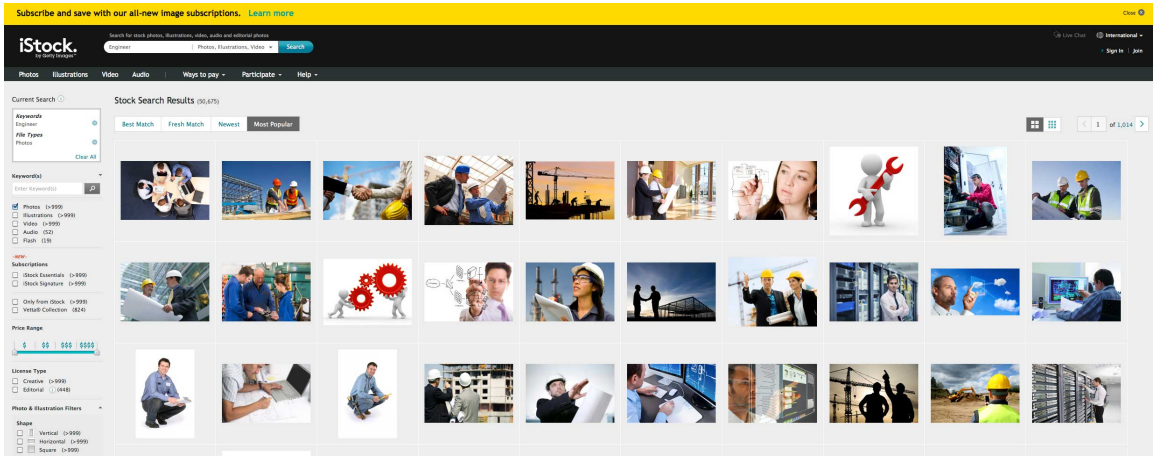
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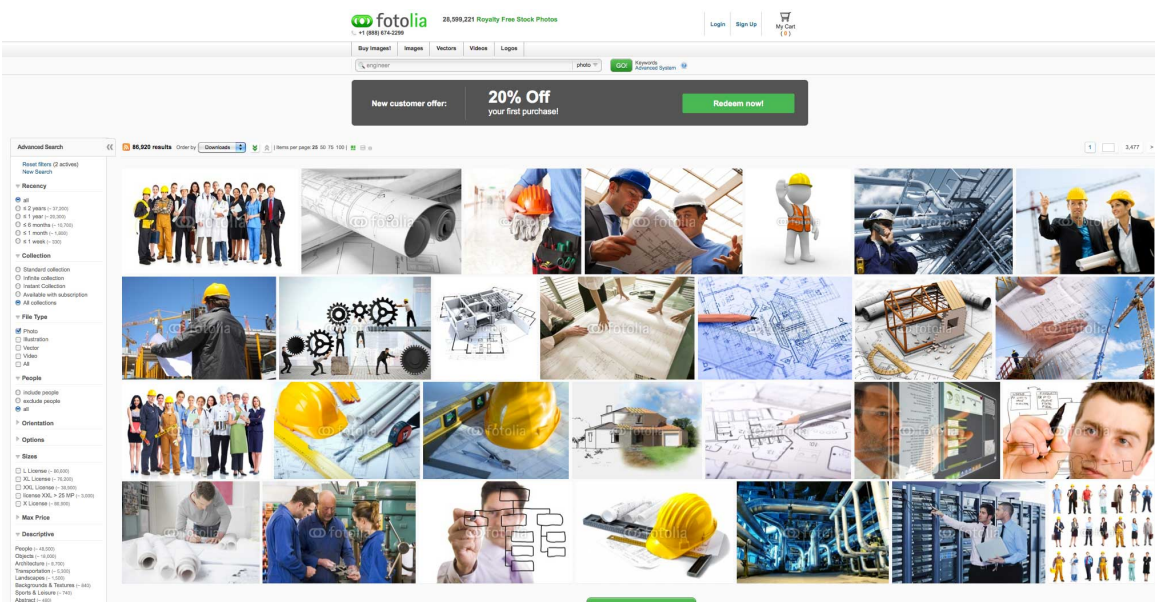
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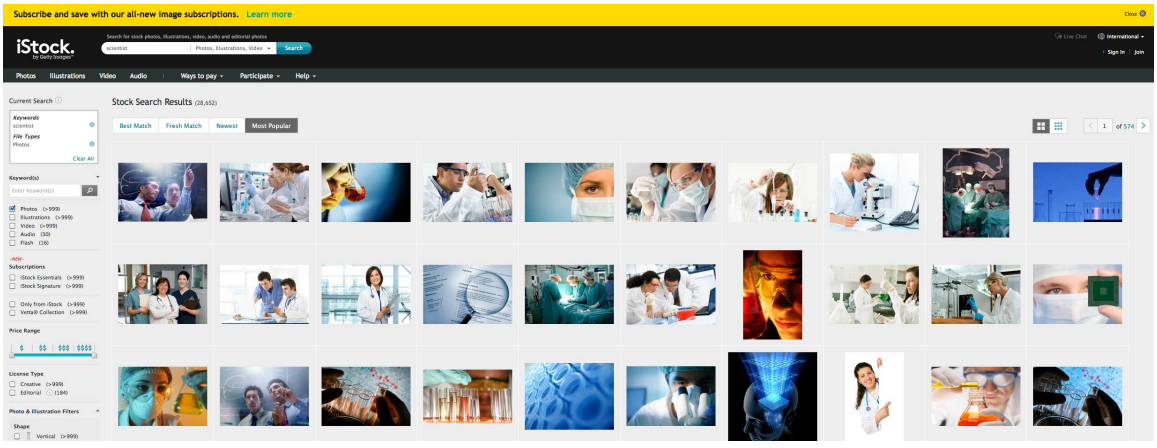
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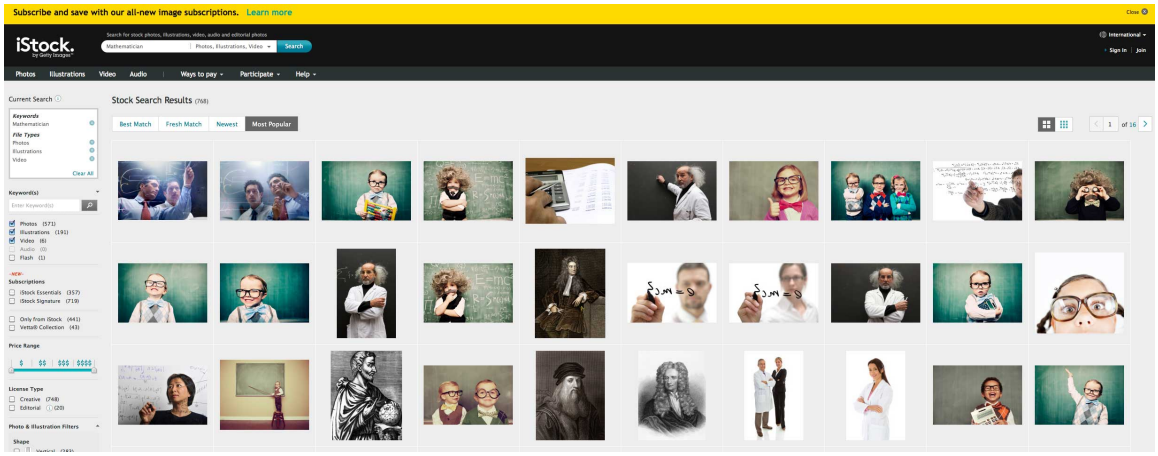
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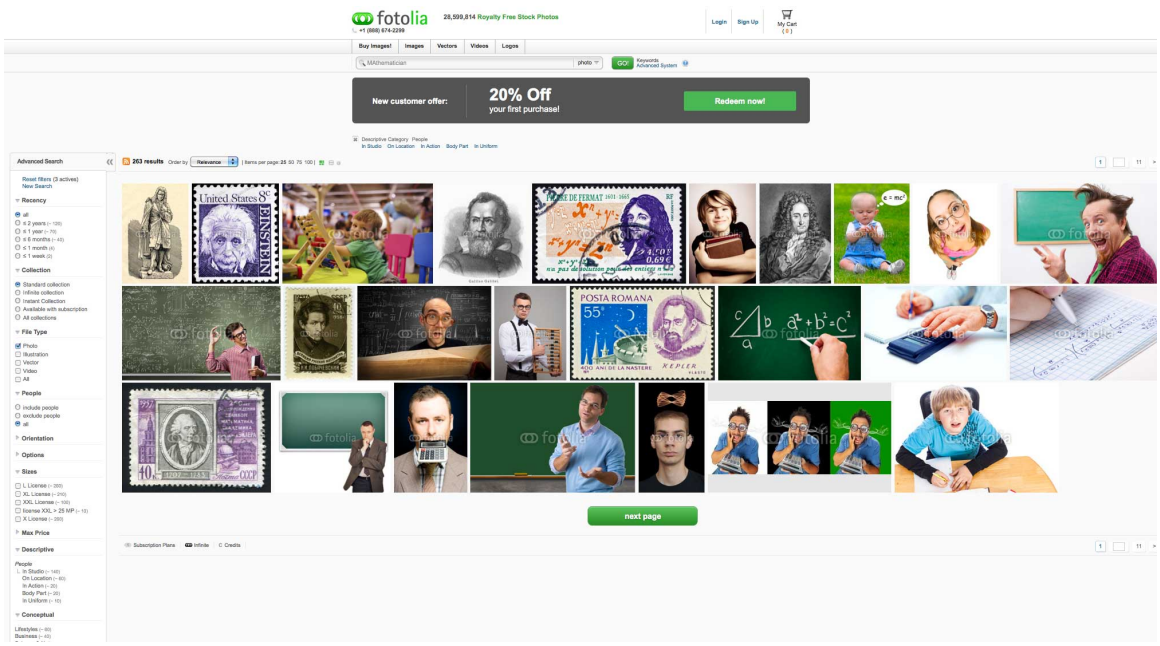
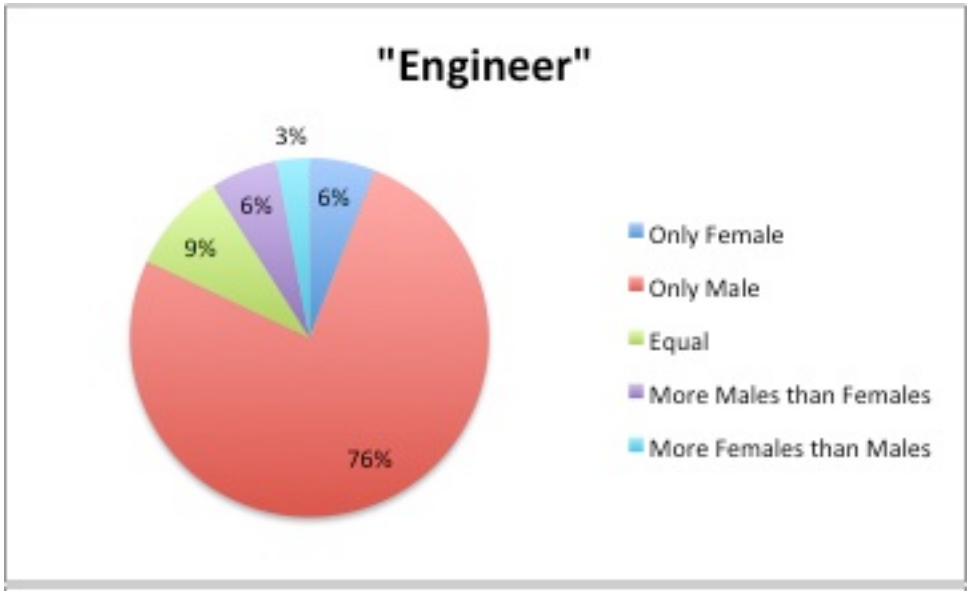
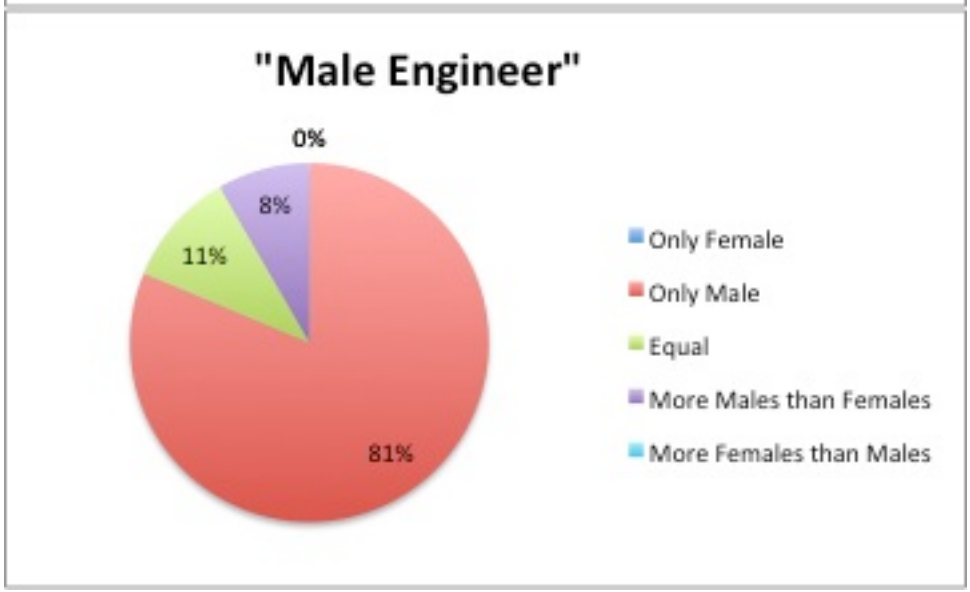
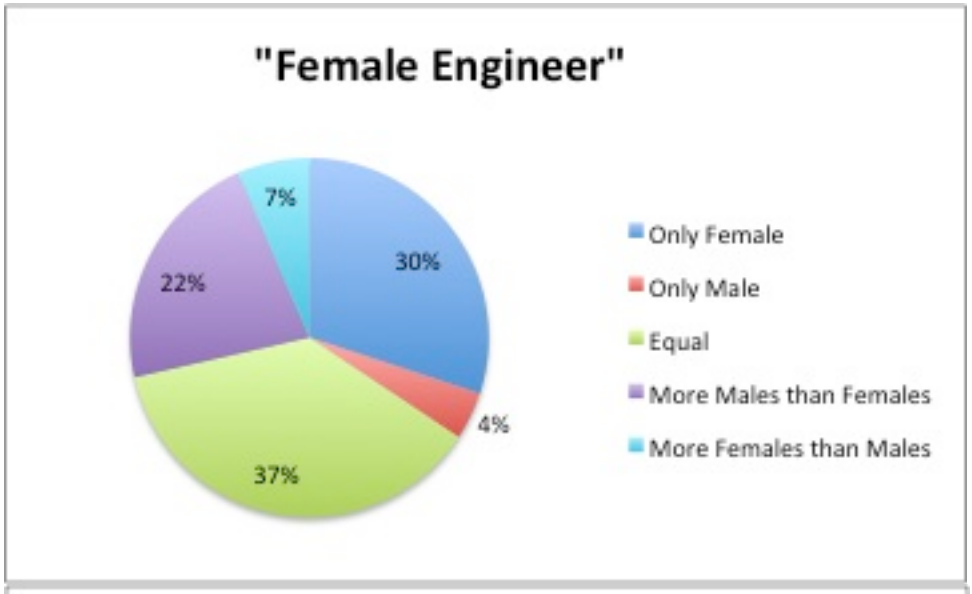


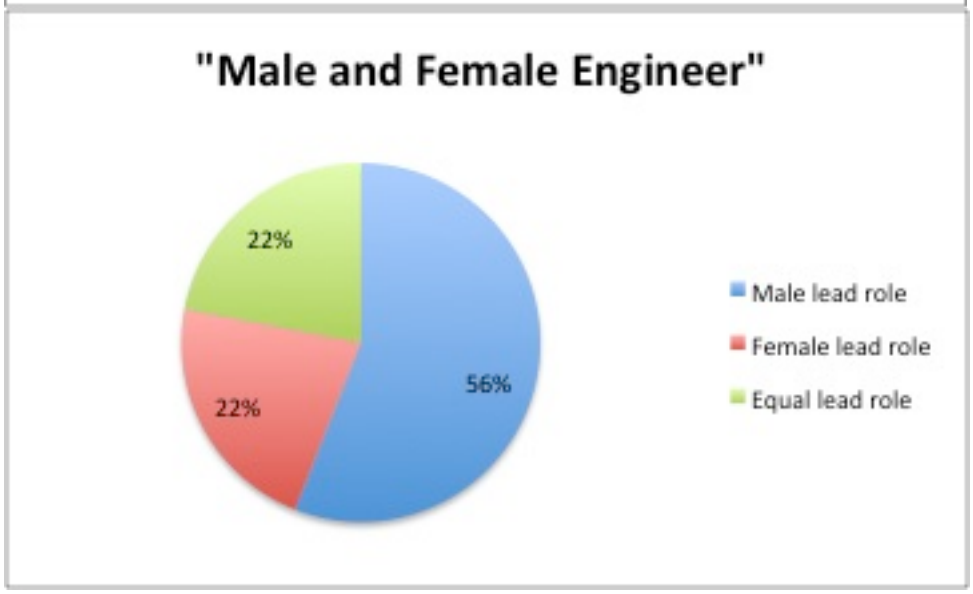
Appendix C: Results

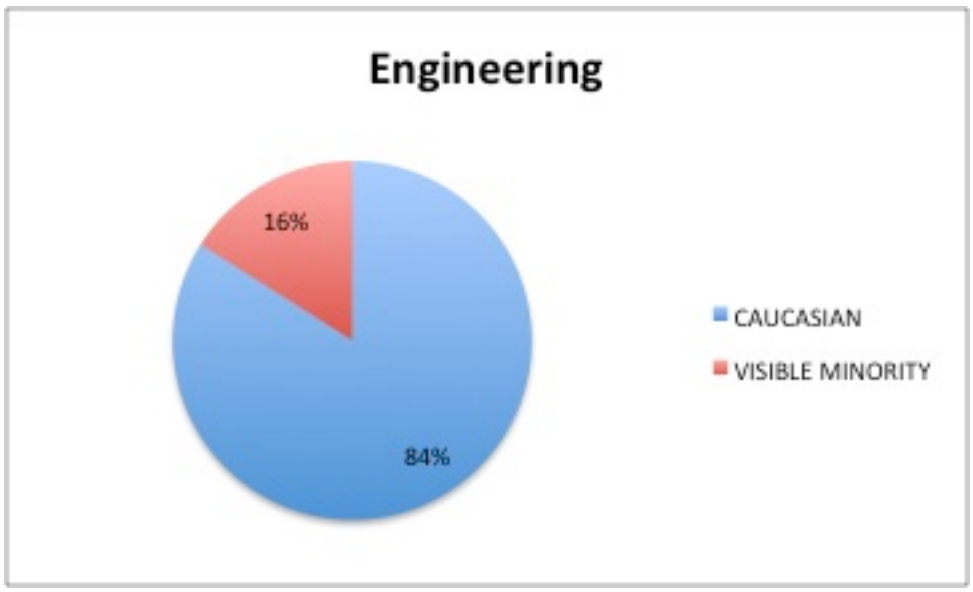
Engineering


"Engineer"
3%
6%
6%
9%
76%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

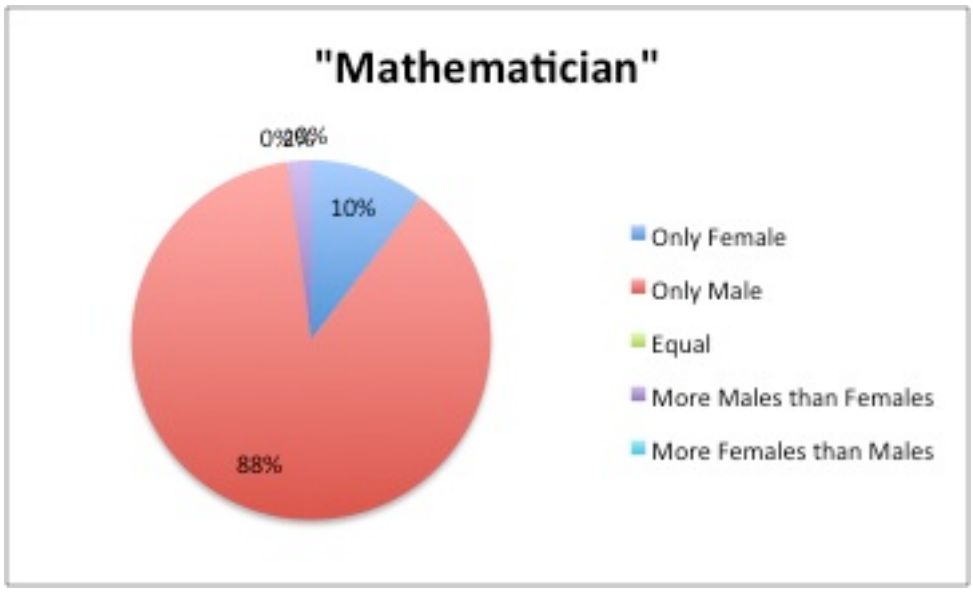

"Male Engineer"
0%
8%
11%
81%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

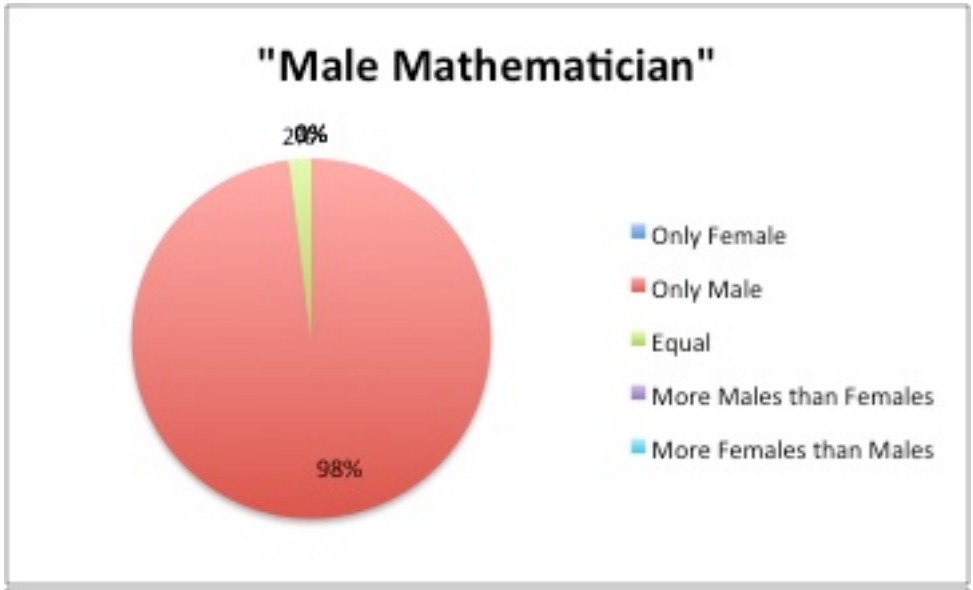

"Female Engineer"
30%
4%
37%
22%
7%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

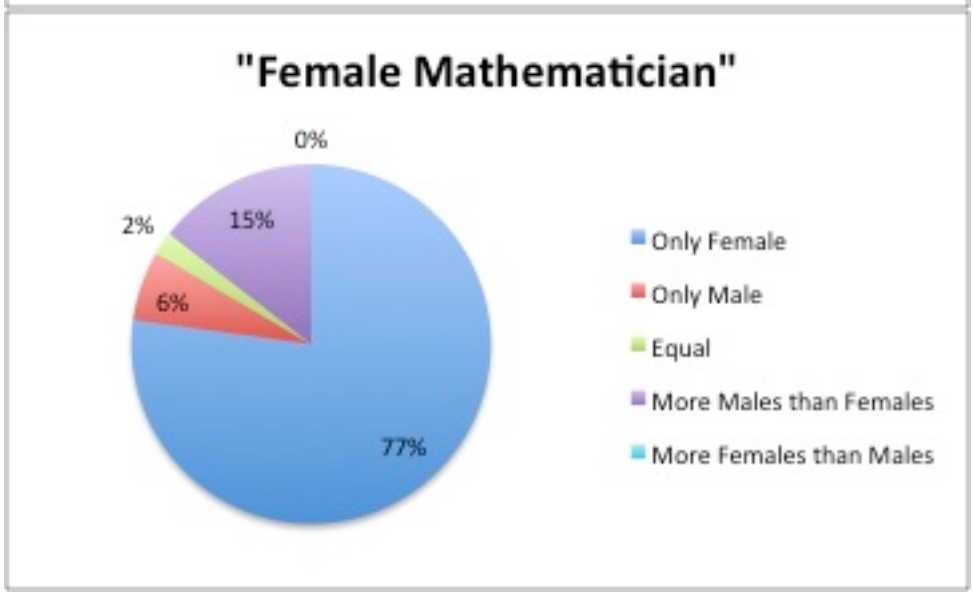

"Male and Female Engineer"
56%
22%
22%
Male lead role
Female lead role
Equal lead role

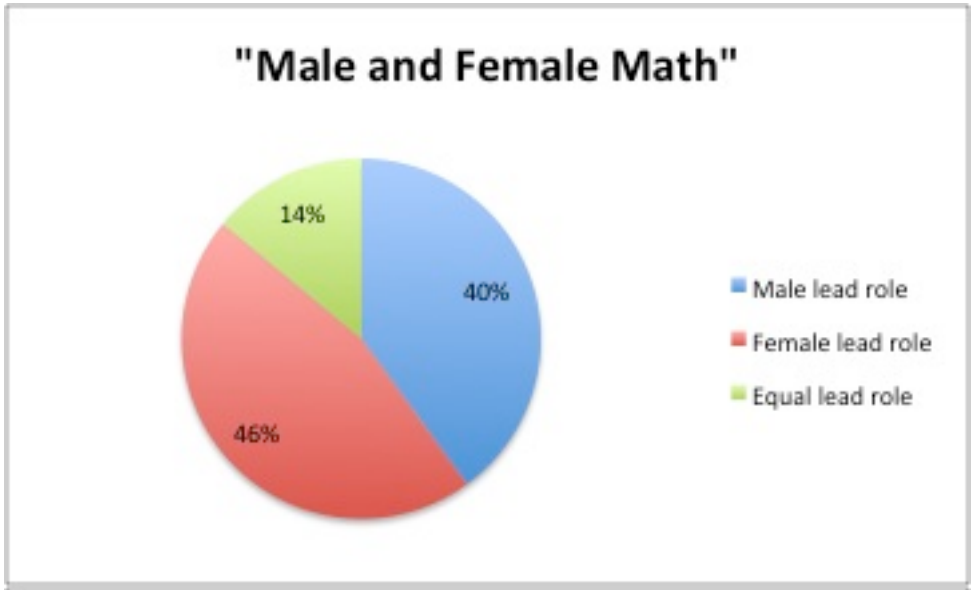

Engineering
16%
84%
CAUCASIAN
VISIBLE MINORITY

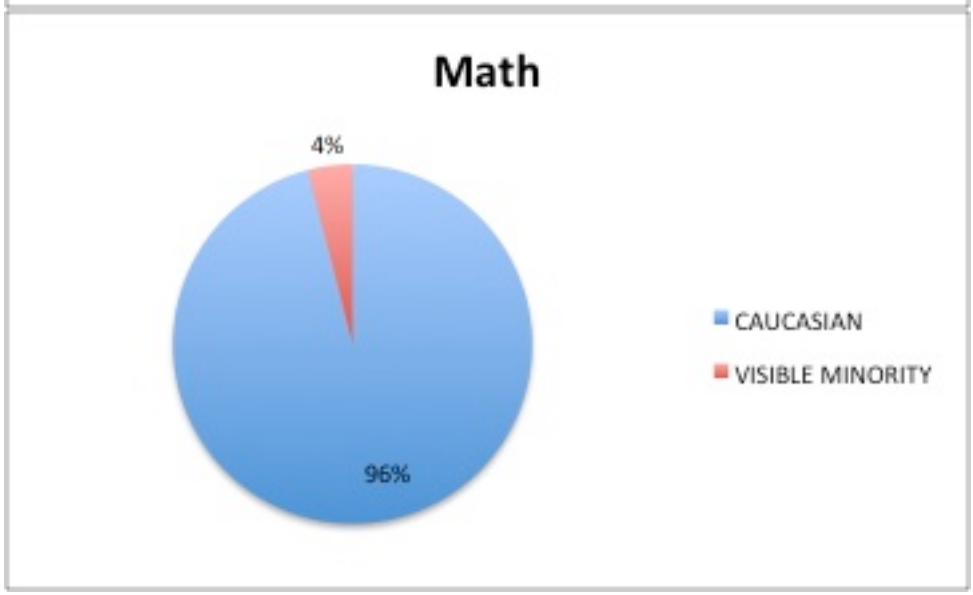
Math


"Mathematician"
10%
88%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

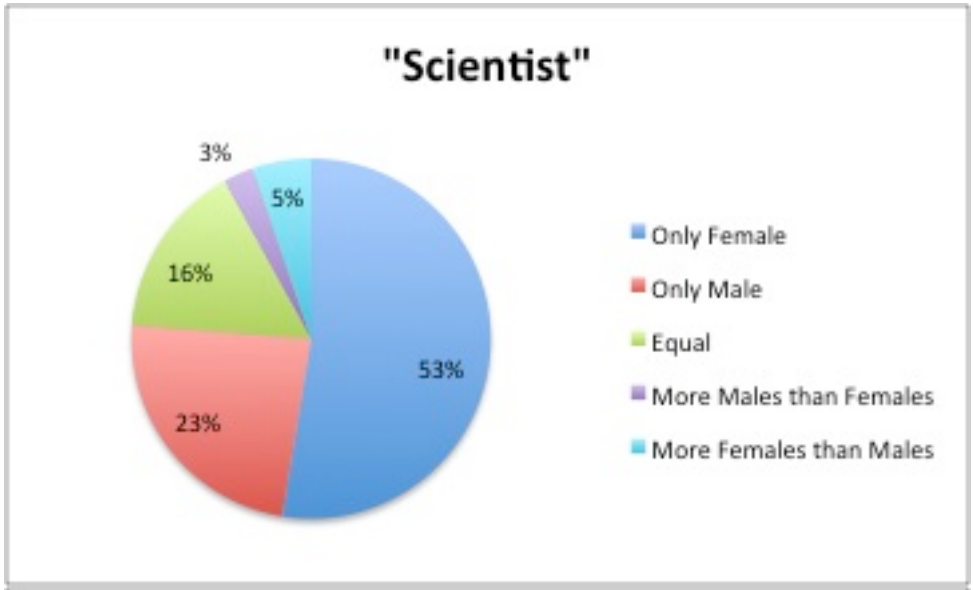

"Male Mathematician"
2%
98%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

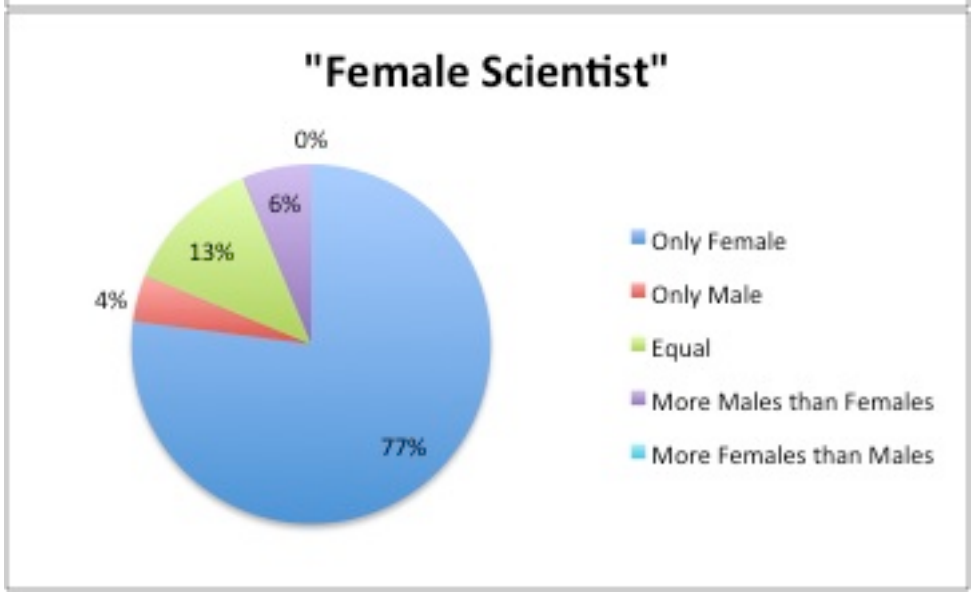

"Female Mathematician"
0%
2%
15%
6%
77%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

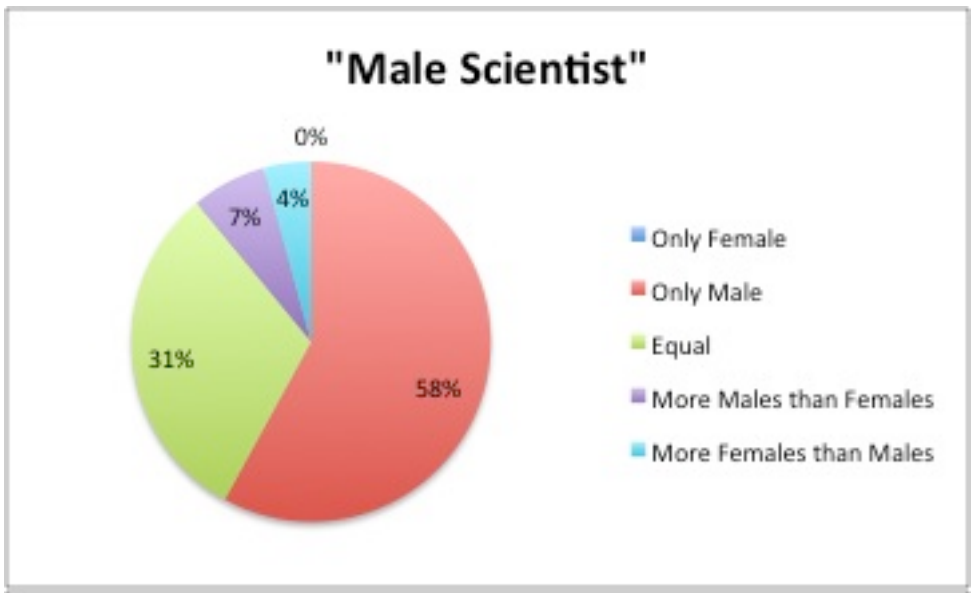

"Male and Female Math"
14%
40%
46%
Male lead role
Female lead role
Equal lead role

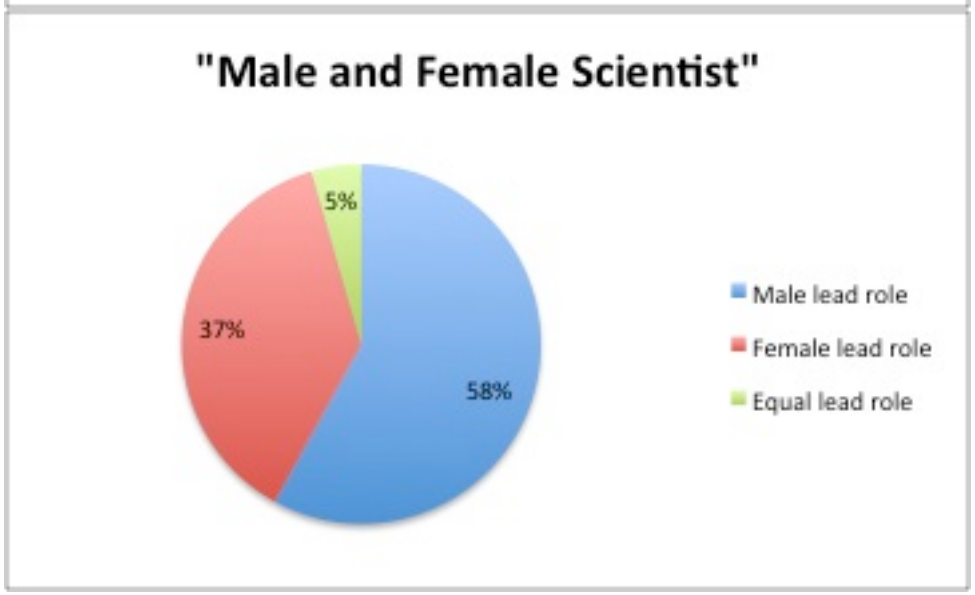

Math
4%
96%
CAUCASIAN
VISIBLE MINORITY

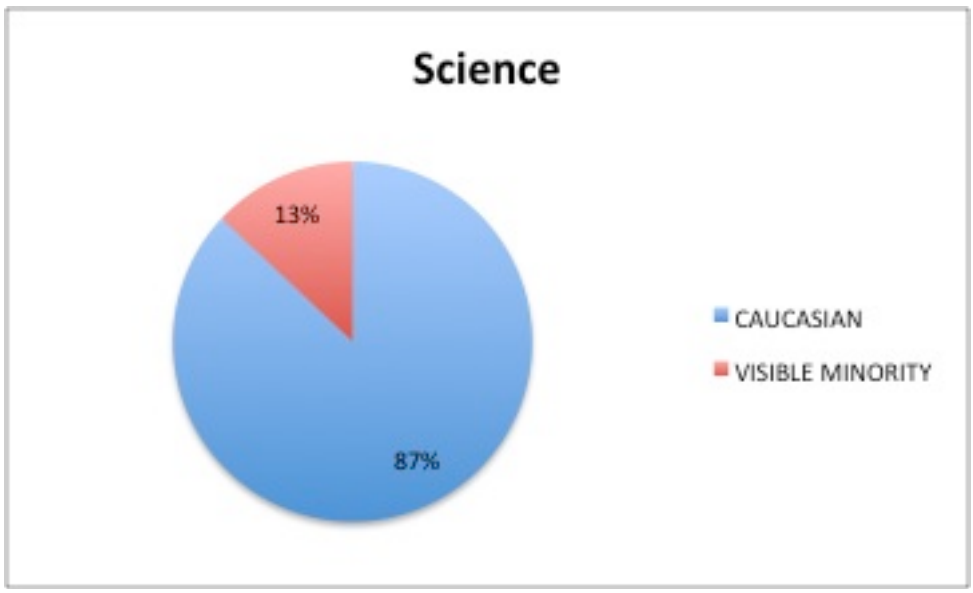
Science


"Scientist"
3%
5%
16%
53%
23%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

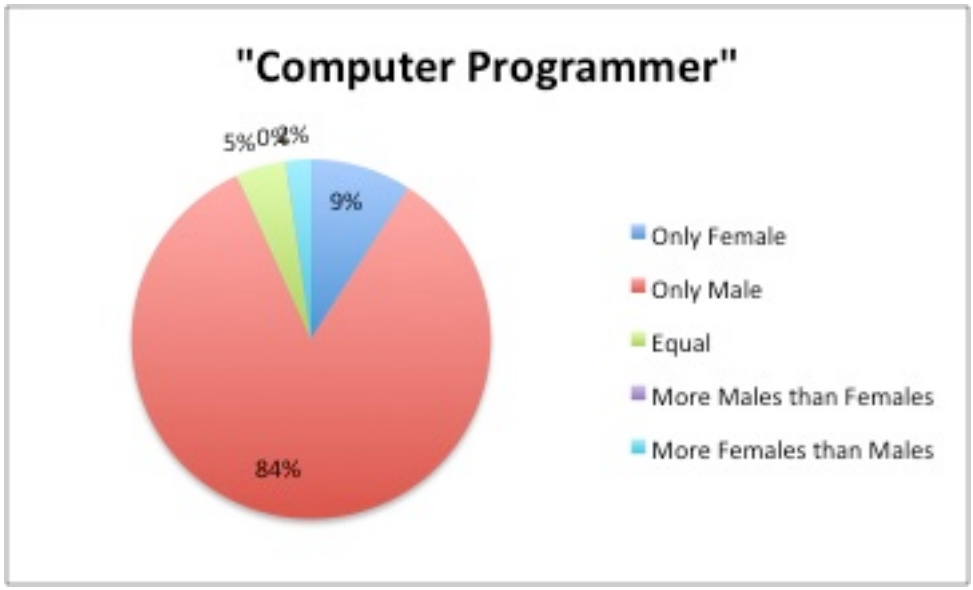

"Female Scientist"
0%
6%
13%
4%
77%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

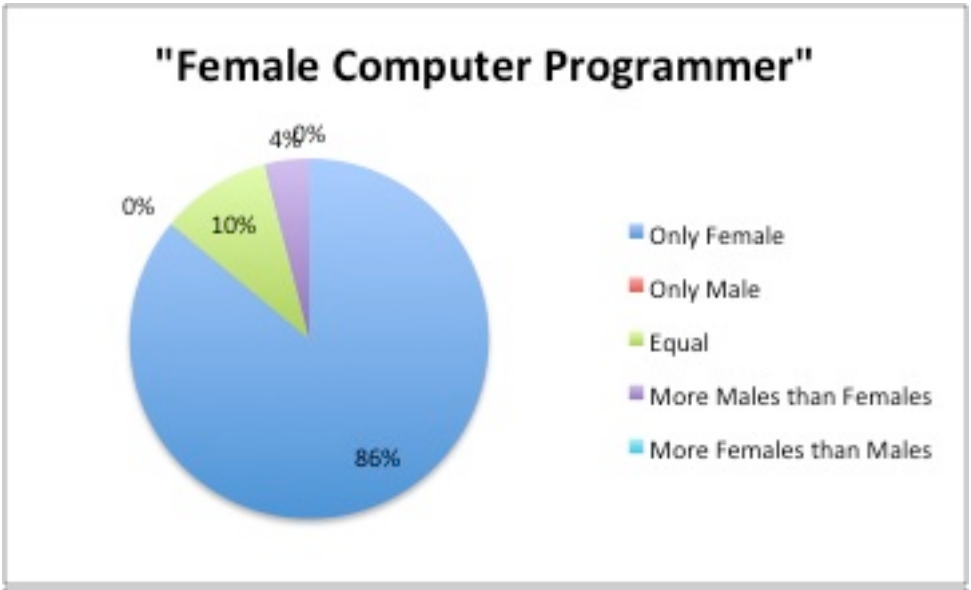

"Male Scientist"
0%
4%
7%
31%
58%
Only Female
Only Male
Equal
More Males than Females
More Females than Males

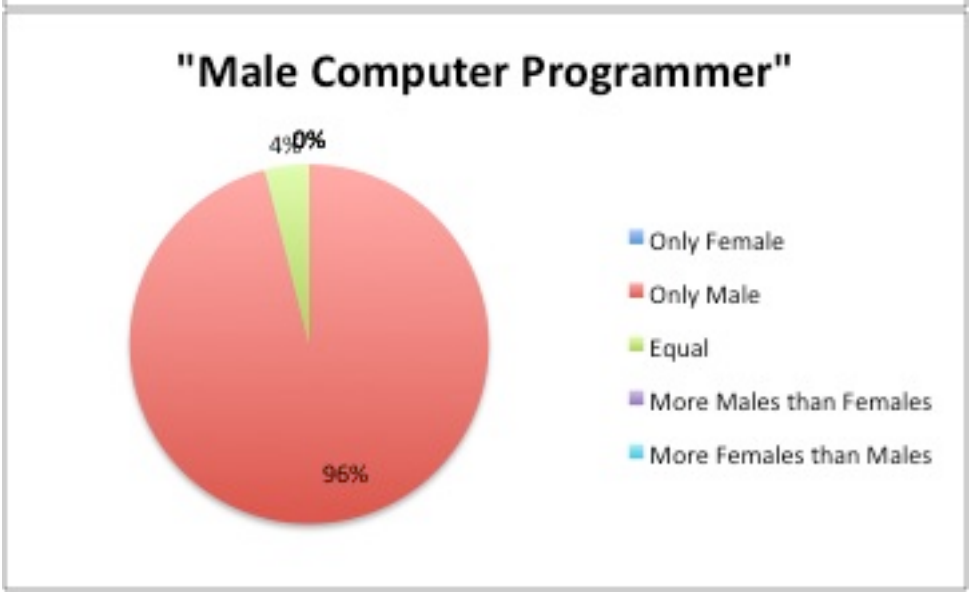

"Male and Female Scientist"
5%
37%
58%
Male lead role
Female lead role
Equal lead role

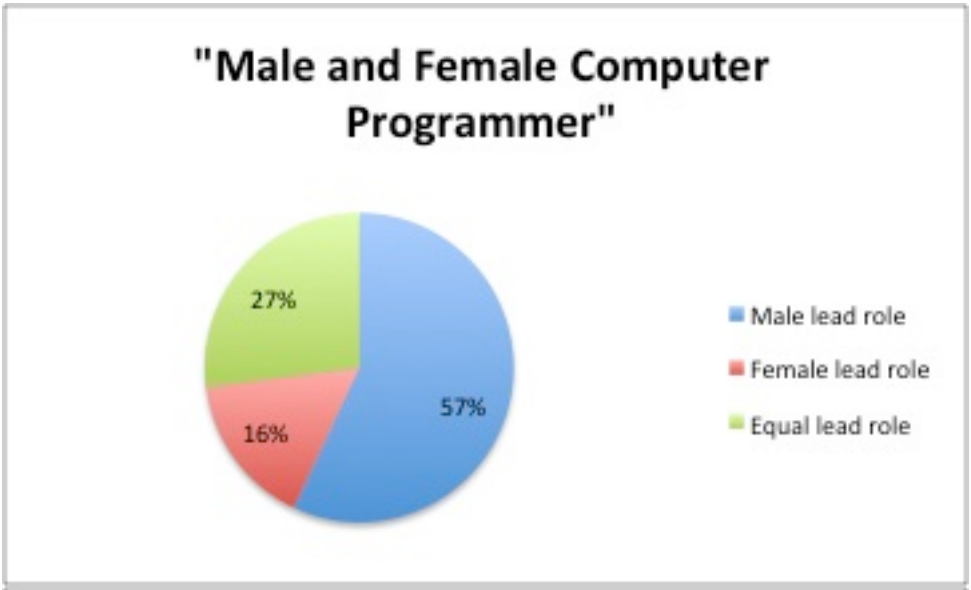

Science
13%
87%
CAUCASIAN
VISIBLE MINORITY

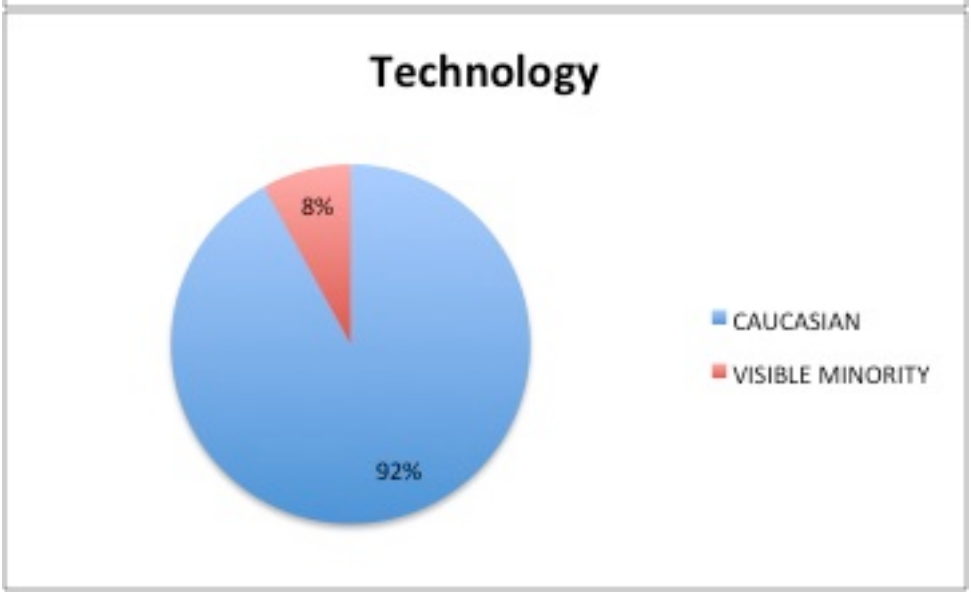
Technology


"Computer Programmer"
5%
0%
2%
9%
84%
Only Female
Only Male
Equal
More Males than Females
More Females than Males


"Female Computer Programmer"
4%
0%
0%
10%
86%
Only Female
Only Male
Equal
More Males than Females
More Females than Males


"Male Computer Programmer"
4%
0%
96%
Only Female
Only Male
Equal
More Males than Females
More Females than Males


"Male and Female Computer Programmer"
27%
57%
16%
Male lead role
Female lead role
Equal lead role


Technology
8%
92%
CAUCASIAN
VISIBLE MINORITY