The Effects of Jargon in STEM Job Advertisements on Genders

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Abstract

Research shows that genders are affected differently by length and word choices in job descriptions. Additionally, research exhibits the existence of a gender confidence gap where women tend not to apply unless they are 100% qualified for the job. Our hypothesis was that women not familiar with the jargon on a job description will not feel completely qualified and be less interested in applying. To investigate this potential unconscious gender bias further, an experiment was performed where people viewed three Navy job descriptions in their respective STEM fields and were asked their level of interest. This paper will show that women who do not have a background in the jargon are less likely to apply on jargon-filled, STEM job descriptions than men. Conversely, when women have a background with the jargon, this paper will show that these women have a higher interest in the jargon-filled job advertisements than men do.

Keywords

Diversity, Jargon, STEM, Job Advertisements, Gender.

Introduction

Research has shown that science, technology, engineering, and mathematics (STEM) careers are male dominated [1]. Among first-year college students, women are much less likely than men to say that they intend to major in STEM. By graduation, men outnumber women in nearly every science and engineering field, and in some—such as physics, engineering, and computer science—the difference is dramatic, with women earning only 20% of bachelor's degrees. Women's representation in science and engineering declines further at the graduate level and yet again in the transition to the workplace [2]. It has been shown that as women move further in their careers, there tends to be a pay gap and promotion disparity between genders [3]. Additionally, occupational segregation throughout all STEM careers is significantly divided by gender [4]. Women make up almost half of the labor force, however they only occupy 25.6% of senior level executive and managerial positions in the private sector [5].

Research has shown that the female confidence gap has influenced this discrepancy. A study gave the same STEM test to women and men and then followed up the test asking the student how they thought they did on the test. The study showed that male and female participants performed the same on a test they were given. However, women predicted that they did far worse than the true grade received [6]. In addition, a study by HP showed that women need to know that their skill level satisfies all 100% of the job advertisement responsibilities while men showed they only need to satisfy up to 60% of the responsibilities listed [7] before applying for the position.

The choice of wording within job advertisements also impacts the likelihood a woman will apply for a job. Even though job advertisements after 1973 no longer include pronouns (e.g., he, she), research shows that gender preferences are found in a more subtle way: the job is described with traits that are stereotypically aligned with a certain gender. Additionally, job advertisements written in both masculine and feminine wording found that women considered jobs less appealing if it contained more masculine wording regardless of the fact the advertisement was for a job in a male or female dominated occupation.[8]. Lastly, the length of a job advertisement was found to affect women negatively more than men [9].

Some word choices affect others by keeping outsiders from their group from understanding the conversation with the use of jargon. For example, a study done by eLife Sciences Organization found that there has been an increase in the complexity of scientific jargon in science journals. This has caused a communication gap between scientists and the average citizen [10]. The word choices can cause a group of people to be included in the conversation or excluded.

This research paper explores how jargon affects men and women when embedded in STEM job advertisements. There can be various forms of jargon within job advertisements such as jargon specific to a domain or to the company. Additionally, a company may use a name they have for their first line supervisor but by stating that internal title in the job advertisement the potential candidate cannot be sure what level of management they are applying for.

This paper will answer the following research questions:

1. Do the original job descriptions sound more appealing to men or women?
2. Does knowing the jargon affect genders differently in the appeal of a jargon filled job advertisement?
3. Would an altered version that has the jargon removed and the length shortened appeal to genders differently?

Section 2 will go over the related works to this study. Section 3 will explain the study that was conducted in detail. Section 4 will go over the results of the study. Section 5 will discuss the limitations and future work. Lastly, Section 6 will conclude the paper.

Related Works

Studies have shown that different genders are affected differently by word choices in job advertisements.

A study from the Journal of Personality and Social Psychology by Gaucher et al. found that male-dominated occupations had a higher percentage of masculine word choices. This was found by sampling at random 493 online job advertisements in the category of 11 job occupations. The male-dominated job types included: plumber, electrician, mechanic, engineer, security guard, and computer programmer. The female-dominated job types included: administrative assistant, early childhood educator, registered nurse, bookkeeper, and human resource professional. To measure the gender of wording, they compiled a list of masculine and feminine words which were formed with a published list of agentic and communal words (e.g., individualistic, competitive, committed, supportive) and masculine and feminine trait words (e.g., ambitious,

assertive, compassionate, understanding). Job advertisements within male-dominated areas contained greater masculine wording than advertisements from female dominated areas [7].

Additionally, research has shown that masculine wording appears to deter women from applying for a job. Gaucher et al. ran an experiment that acquired 96 participants and showed ⅓ of them male dominated roles, ⅓ female dominated roles, and then the last ⅓ a gender-neutral role. The gender words were used to fill job advertisements that were feminine and masculine word choices in a male-dominated occupation as well as feminine and masculine word choices for female dominated jobs such as nursing. For example, the engineering job advertisement qualification with masculine language would be, “Strong communication and influencing skills. Ability to perform individually in a competitive environment. Superior ability to satisfy customers and manage the company’s association with them. Bachelor’s in Engineering degree or higher from recognized University. Registered as a Professional Engineer.” and the same job advertisement qualifications converted to feminine language would be, “Proficient oral and written communication skills. Collaborates well, in a team environment. Sensitive to clients’ needs can develop warm client relationships. Bachelor’s in Engineering degree or higher from recognized University. Registered as a Professional Engineer.” It came to show that the choice of words matters to women yet has no statistically significant effect on men [8]. This study highlighted women’s perception of belongingness to the organization rather than their perception of their ability to perform the job [11].

Jargon is special words or expressions that are used by a particular profession or group and are difficult for others to understand [12]. Jargon hinders our ability to communicate across disciplines: highly specialized scientists can communicate their ideas freely with others in their field but cannot be understood by those outside of it. It limits our understanding of medical, scientific, and technological advances and litters our job descriptions. Jargon is an internal language that is only understood by those within the group already, but those who are on the outside will not be able to comprehend or communicate properly because jargon acts as a barrier between internal and external groups [13]. Jargon is a word barrier that does not allow two persons from different cultural, social, or occupational backgrounds to communicate [14].

Jargon can be identified within text by using frequency counting on words in literature used to communicate with the average adult like news articles. Words that are used less frequently are then considered jargon. Rakedzon et. al. used this approach by training an algorithm to count the frequency of 250,000 articles that contained over 90 million words from the BBC website from 2012-2015. This algorithm was then used to observe scientific abstracts and summaries to identify if the percent of jargon is more than what is recommended to communicate for the public's comprehension [15].

Method

To study the effects of jargon, an experimental online survey was developed. This survey was distributed in an internal Navy collaboration platform in order to capture individuals who already work as Naval personnel. Additionally the survey was distributed to people outside the Navy who signed up to be on a Navy civilian recruiter list and posted on USAJobs Opportunities [16].

The survey was completed by 111 people, 56 men and 55 women.[Note - One person reported their gender identity as “other” as was excluded from the analysis.] All participants were over 18

years of age, and all survey data was gathered anonymously using the Qualtrics survey platform. Participants were asked if they had education or experience in engineering, information technology, mechanic or technician work, or data analysis. The participants could only choose one of the four categories, and based on their selection were brought to three educationally appropriate job advertisements to read and to evaluate. Participants were randomly assigned to see either an original job description or an altered job description for each of the three job advertisements. The participants were then asked after each description if the job appealed to them, if they would send the job to a male colleague, and if they would send the job to a female colleague. At the end of the survey participants were asked what gender they identified as: male, female, or other.

The original job descriptions were taken as a sample from posting on USAJobs [17] for a job within Naval Sea Systems Command Port Hueneme Division which "employs more than 2,500 engineers, scientists, technicians, logisticians, and support personnel who provide America's Naval surface fleet with integration, test and evaluation, life-cycle engineering, and product support for today's and tomorrow's warfare systems [18]."

These original job descriptions had on average 177.2 words and averaged 8 bullets in the description. The alternative versions had on average 79.2 words and averaged 6.1 bullets in the description. Again, these alternative descriptions were written in such a way as to reduce the jargon within the description and to simplify the advertisements. See Table 1 for the breakdown between job type and number of jargon words. The jargon words were found using the open source De-Jargonizer algorithm [15]. Jargon words are considered words with a frequency of less than 1,000 while rare words are indicated in the tool to be words of frequency less than 50.

Table 1: Number of Words, Bullets, Rare Words, and Jargon Words for each Job Category Assessed

Job Category	Job Description Type	Average number of words	Average number of bullets	Average number of rare words	Average number of jargon words
Engineer	Original	158	7.3	10.6	20.6
	Altered	75	5.3	0	7
Technician	Original	127.3	6.3	5.6	19.6
	Altered	57	4	0	9.3
IT	Original	183	8.3	3.3	23.6
	Altered	63.6	6.3	1.3	9.6
Data Analyst	Original	240.6	10	7.3	34
	Altered	121.3	8.6	0	14

Table 1: This table describes the original and altered job descriptions that were used in the online survey. Notice that the length of the job description and the number of jargon words reduced with the altered version.

As demonstrated, the altered version greatly reduced the number of jargon words and simplified the length of the description. Each altered description was verified by a subject matter expert in the job field to ensure that the job responsibilities were accurately depicted.

Respondents were asked to indicate how interested they were in the provided advertisement (1=not interested, 2=somewhat interested, 3=very interested). Several variables were created in order to test for whether respondents were more interested in one type of advertisement than the other. Specifically, we created three standardized interest scores based on their summed interest by advertisement type and then divided by the number of advertisement versions each respondent saw. A person who saw 1 original advertisement type and 2 alternative advertisements have three interest scores: a total score which adds all levels of interest divided by three, an original interest score which takes the interest level for the one original advertisement and divides it by 1, and an alternative interest score which takes the total interest levels across the 2 alternative versions and divides it by 2. This standardization allows us to maintain the three-point interest scale as well as appropriately account for how many advertisement types were seen.

Descriptive statistics are presented below in Table 2 with three panels (one for all job advertisement types, one that focuses on just the original job advertisements, and lastly one for focusing on the alternative job advertisement type). Each panel provides the number of respondents who assessed any advertisement, at least one original advertisement, and at least one alternative advertisement. Missing Ns within the second and third panel (for original and alternative advertisements) indicates that this number of respondents did not view any of this advertisement type. For example, there are 18 respondents identified as missing for the alternative advertisement which means that 18 of the 111 respondents were not presented with an alternative advertisement to assess. Each panel also includes columns for each subgroup of interest: current naval personnel, those who do not currently work within the navy, men, women, male naval personnel, male non-naval personnel, female naval personnel, and female non-naval personnel.

Table 2: Level of Interest Across All Advertisement Types

						Men		Women	
	All	Non-Navy	Navy	Men	Women	Non-Navy	Navy	Non-Navy	Navy
Valid N	111	66	45	56	55	29	27	37	18
Missing N	0	0	0	0	0	0	0	0	0
Mean	2.08	2.24	1.86	2.15	2.01	2.47	1.81	2.05	1.93
Median	2.00	2.33	1.67	2.33	2.00	2.67	1.67	2.00	2.00
Std. Dev	0.62	0.66	0.49	0.62	0.62	0.57	0.48	0.67	0.51

Table 3: Level of Interest Across Original Advertisements Only

						Men		Women	
	All	Non-Navy	Navy	Men	Women	Non-Navy	Navy	Non-Navy	Navy
Valid N	100	56	44	49	51	23	26	33	18
Missing N	11	10	1	7	4	6	1	4	0
Mean	2.00	2.19	1.76	1.99	2.01	2.42	1.62	2.04	1.96
Median	2.00	2.00	1.67	2.00	2.00	2.67	1.42	2.00	2.00
Std. Dev	0.78	0.79	0.68	0.79	0.77	0.67	0.70	0.84	0.63

Table 4: Level of Interest Across Alternative Advertisements Only

						Men		Women	
	All	Non-Navy	Navy	Men	Women	Non-Navy	Navy	Non-Navy	Navy
Valid N	93	54	39	48	45	23	25	31	14
Missing N	18	12	6	8	10	6	2	6	4
Mean	2.14	2.25	1.98	2.19	2.09	2.44	1.95	2.11	2.04
Median	2.00	2.33	2.00	2.0	2.00	2.50	2.00	2.00	2.00
Std. Dev	0.67	0.70	0.59	0.66	0.68	0.64	0.60	0.72	0.60

Table 4: Descriptive statistics by job advertisement type and subgroup. 111 people completed the survey; 56 were men and 55 were women. The non-Navy demographic are the people that are assumed not to have Navy jargon knowledge while the Navy demographic are people who are assumed to have that special understanding of the job advertisement jargon. Each person saw three job advertisements - randomly an original or alternative - so each type of job advertisement was averaged per person. The mean, median, and standard deviation are descriptive statistics of the average original and average alternative interest level rating per person (where 1 is not interested and 3 is very interested).

Results

Several analyses were conducted to assess whether advertisement type was related to respondents' interest levels and whether interest levels varied within and across subgroups. Specifically, we tested whether individuals preferred one type of advertisement over another

using a within-person paired samples test. This test assesses whether the average interest in original advertisements is significantly different than the average for alternative advertisements for each individual (for example, does Respondent 1 express more interest in original advertisements or alternative advertisements). We also utilized independent sample means tests to assess between group comparisons (for example, do men express greater interest in original advertisements than women). We will first present the within-person analysis followed by the between-group analysis.

Table 5 presents the paired sample tests for respondents. In order to be included in this analysis, a respondent had to have seen at least one of each type of advertisement (original and alternative). The difference between those scores was calculated for each individual and then averaged to determine if individuals expressed significantly more interest for the original or alternative advertisements. Of all respondents, 82 individuals saw at least one type of advertisement, had an average interest score of 1.99 for original advertisements, and an average interest score of 2.10 for alternative advertisements. This difference in average score is not significant. The only group with a significant difference in interest were Navy men; these men expressed significantly more interest in the alternative advertisements than the original advertisements they assessed (t=-0.1922, p=0.034).

Table 5: Paired Sample Tests by Respondent Type

	N	Original ads	Alternative ads	Mean difference	t	p
All cases	82	1.99	2.10	-0.11	-1.229	ns
Men	41	1.93	2.12	-0.2	-1.522	ns
Women	41	2.06	2.09	-0.02	-0.196	ns
Non-Navy	44	2.17	2.19	-0.02	-0.198	ns
Navy	38	1.79	2.00	-0.21	-1.51	ns
Men						
Non- Navy	17	2.35	2.32	0.03	0.187	ns
Navy	24	1.63	1.98	-0.35	-1.922	*
Women						
Non-Navy	27	2.06	2.11	-0.06	-0.345	ns
Navy	14	2.07	2.04	0.04	0.179	ns
*p<.05, **p<.01, ***p<.001						

Table 6: Paired samples tests for difference in interest levels. Men within the Navy, who already know what the jargon means, are less interested in the original jargon advertisement than the

alternative with a statistical significance ($p<.05$). Women, both Navy and Non-Navy, showed an increase in interest on average to the alternative job advertisements, however, this difference is not statistically significant.

According to the literature, women may be more interested in job advertisements that highlight feminine language and that are less jargon-heavy since those are less likely to activate confidence gaps. To that end, Table 6 presents between-group differences by gender. These tests compare men's average interest levels to women's average interest levels by each advertisement type with sub-analyses for whether or not the respondents were Naval personnel. Altogether, there are no gender differences between men and women when Naval personnel status is not taken into account. However, there are significant gender differences when Naval personnel status is considered. Specifically, non-Naval men are significantly more interested in all jobs advertisements (both original and alternative) than non-Naval women ($p<.05$). Among Naval personnel, this pattern flips such that women are significantly more interested in the original advertisements than men (mean 1.96 vs 1.62, respectively, $p<.05$). This pattern holds for alternative advertisement as well; however, this difference is not significant.

Table 6: T-test Comparisons of Interest by Gender

	Men	Women	t	one-tail p
All				
Total	2.15	2.01	1.21	ns
Original	1.99	2.01	-0.107	ns
Alternative	2.19	2.08	0.734	ns
Non-Navy				
Total	2.47	2.05	2.662	**
Original	2.42	2.04	1.823	*
Alternative	2.44	2.11	1.762	*
Navy				
Total	1.81	1.93	-0.742	ns
Original	1.62	1.96	-1.69	*
Alternative	1.95	2.04	-0.411	ns
*p<.05, **p<.01, ***p<.001				

Because these STEM jobs were particular to Naval occupations, it is also important to test for difference by Navy personnel status. Table 7 presents these between-group differences by Naval

status. These tests compare the average interest levels of those who are not currently working within the Navy to those who are with sub-analyses for gender. Although it at first appears that there are significant differences based on naval personnel status, it is clear that these are being driven by the men in the sample. Men who are currently non-Navy express significantly more interest in all advertisement types (both original and alternative) than men who are in the Navy.

Table 7: Between Group Differences: Naval Status

	Navy	Non-navy	t	one-tail p
All				
Total	1.86	2.24	-3.272	***
Original	1.76	2.19	-2.892	**
Alternative	1.98	2.25	-1.926	*
Men				
Total	1.81	2.47	-4.661	***
Original	1.62	2.42	-4.101	***
Alternative	1.95	2.44	-2.733	**
Women				
Total	1.93	2.05	-0.714	ns
Original	1.96	2.04	-0.347	ns
Alternative	2.04	2.11	-0.323	ns
*p<.05, **p<.01, ***p<.001				

Limitations and Future Work

This research produced results that give us insight on how jargon affects genders differently when it comes to job advertisements, however, there were some limitations to the study. First, the data size was too small to make broad conclusions. Second, age and other demographics were not captured; this data may provide insight into the affect jargon has on different identity groups. Future work can extend this study to gather more demographic data and to add questions for the reason for the interest level. Third, there was no question in the survey to ask if they understood the jargon or had a background with the Navy. Instead, the link to the non-Navy survey was distributed through a USA Jobs Opportunities page and emailed by a recruiter therefore it has to be assumed that the non-Navy participants do not have a Navy background to understand the terminology in the advertisements. Future work can look more closely on the

correlation of interest level in a jargon filled job advertisement and a person's expertise in an area. Fourth, this experiment was set up with an online survey and did not mimic the more realistic application process, therefore the interest level may be different if the participant had to do the extra labor of putting a resume together for the job. Fifth, this study focused on observing the relationship between a participant's interest level in a job and jargon within the genders, however, the future work should extend the study to see if the quality of applicant is sacrificed when jargon is removed. Also, future work can look more into how jargon in job advertisements affects the interest to share the job with another person. Lastly, there have been studies that have shown that women's interest level of a job is affected by the belongingness to the organization hiring [19]. Future work should extend this study to look further into how belongingness is affected by jargon as well.

Conclusion

These results show that there is a statistically significant difference in interest level between men and women who do not have a background in the jargon. Women have exhibited to be less interested in the jargon-filled job advertisement than men where both genders did not have a background in the jargon. Conversely, women who do know the jargon were more interested in the jargon-filled original version than men who also know the jargon. All genders and backgrounds showed a statistical significance in becoming some level of interest (somewhat or very) with the non-jargon, alternative version. When investigating whether jargon affects genders differently, the results showed an increase in interest level for non-Navy women, however, it is not statistically significant the difference as expected with the hypothesis. Conversely, men who know the Navy jargon were the only demographic group that showed a statistically significant increase in interest level for the alternative job advertisement over the original one with jargon. Therefore, jargon does affect genders differently but not necessarily in the way expected. In regards on how to change a job advertisement for STEM women to become more interested in these STEM jobs, this may be more complicated than jargon, length of job advertisement, or gender neutral word choices; it may be also caused by the level of belongingness the candidate feels to the organization posting the job advertisement or other factors. Future work can explore the reasons for this result and see if the quality of the applicant suffers if jargon is removed.

References

1 Correll, Shelley, "Gender and the Career Choice Process: The Role of Biased Self-Assessments", The University of Chicago Press Journals, American Journal of Sociology, 2001, pg 161-1730.

2 Hill, Catherine, Corbett, Christian, and St. Rose, Andresse, "Why so Few? Women in Science, Technology, Engineering, and Mathematics", American Association of University Women, 2010, pg 11, 27.

3 Schieder, Jessica, and, Gould, Elise, "'Women's work' and the gender pay gap: How discirmination, societal norms, and other forces affect women's occupational choices - and their pay" Economic Policy Institute, 2016.

4 Funk, Cary, and, Parker, Kim, "Women and Men in STEM Often at Odds Over Workplace Equity: Diversity in the STEM workforce varies widely across jobs", Pew Research Center, 2018.

5 He, Joyce, and, Kang, Sonia, "Covering in Cover Letters: Gender and Self-Presentation in Job Applications", University of Toronto, Academy of Management, 2019.

6 Erhlinger, Joyce, and, Dunning, David, "How chronic self-views influence (and potentially mislead) estimates of performance", Journal of Personality and Social Psychology, 2003.

7 Kay and Shipman. "The Confidence Gap." The Atlantic. May 2014. https://www.theatlantic.com/magazine/archive/2014/05/the-confidence-gap/359815/.

8 Gaucher, Danielle, and, Friesen, Justin, and, Kay, Aaron, "Evidence that gendered wording in job advertisements exists and sustains gender inequality" Journal of Personality and Social Psychology, 2011.

9 Sanchez, Cassie, "How to write a job description in 2020: Best practices from half a billion job postings", Textio, 2020.

10 Plaven-Sigray, Pontus, Matheson, Granville James, Schiffler, Bjorn Christian, and, Thompson, William Hedley, "The readability of scientific texts is decreasing over time", eLife, 2017.

11 Leslie Krome. "Attracting Women to STEM Programs: The Influence of Goal-Orientations and the use of gendered wording in recruitment materials." 2016. Kansas State University Doctor of Philosophy Dissertation.

12 "Definition of Jargon", Oxford University Press, Lexico, 2021

13 Rakedzon, Tzipora, Segev, Elad, Chapnik, Noam, Yosef, Roy, and, Baram-Tsabari, Ayelet, "Automatic jargon identifier for scientists engaging with the public and science communication educators" Public Library of Sciences One, 2017.

14 Bullock, Olivia, Amill, Shulman, and Dixon. Jargon as a Barrier to Effective Science Communication: Evidence from Metacognition. Public Understanding of Science. https://comm.osu.edu/sites/comm.osu.edu/files/PUS%202019-%20Bullock%20et%20al..pdf. DOI: 10.1177/0963662519865687. 2019.

15 Rakedzon, Tzipora, Segev, Chapnik, Yosef, and Baram-Tsabari. "Automatic Jargon Identifier for Scientists Engaging with the Public and Science Communication Educators." PLOS ONE 12 (8): e0181742. 9 August 2017.https://journals.plos.org/plosone/article/comments?id=10.1371/journal.pone.0181742.

16 "Open Opportunities Powered by USA Jobs." USA Jobs. U.S. Office of Personnel Management (OPM). https://openopps.usajobs.gov

17 U.S. Office of Personnel Management (OPM), USA Jobs. https://www.usajobs.gov

18 "About NSWC Port Hueneme" Naval Sea Systems Command (NAVSEA). https://www.navsea.navy.mil/Home/Warfare-Centers/NSWC-Port-Hueneme/Who-We-Are/

19 "Diversity and Positive Discrimination: The Effects of Gender Diversity Management in the Recruitment Process on Potential Job Applicants." Communication Science, Organizational Communication & Reputation, BMS Faculty, University of Twente, 2020.