

Is New Product Development Impacted by the Manager's Gender? The Case of Motion Pictures

Kate Karniouchina
Mills College

Carol Theokary
Mills College

Lorien Rice
Mills College

Can Uslay
Rutgers University

Siobhan Reilly
Mills College

Abstract

The authors examine differences in movies directed by men versus women. Drawing from a broad sample of almost 5,000 movies, the authors conduct an in-depth thematic variation analysis, and also explore the differences in movies directed by men versus women by examining budgets, film length, and product quality. Results indicate that while men direct longer, higher budget movies that receive wider distribution, the differences in movie quality ratings are insignificant, suggesting that women directors may be more cost efficient in generating quality outcomes. While women directors are more likely to focus on genres that rely on the quality of the dialog and creativity (e.g., dramas and musicals), men are more likely to direct projects that rely on technical execution and special effects.

Introduction

While gender effects have been found to be relevant within the New Product Development (NPD) arena and a relatively large body of research has explored the gender-related nuances of new product success, extant research has concentrated on the consumption rather than the design and production sides of the NPD process. Existing NPD and marketing literatures have primarily explored how people of different genders respond to various types of products, online shopping,¹ website design,^{2,3} or how gender roles and associated biases permeate TV ads for products around the globe.^{4,5,6} In addition, brands themselves could be positioned along the gender-related femininity-masculinity continuum, and gender-related congruence has been found to be important while introducing brand extensions.⁷

Previous literature has focused on the perpetuation of gender stereotypes⁸ in the advertising of new products, the above-mentioned gender-specific variations in consumer preferences, or a so-called “pink tax”⁹ where women pay a premium for basic products and services. However, the literature has largely ignored women's role in product ideation and development. In particular, the literature has not explored the impact that the project lead's gender can have on the characteristics of new products that are being introduced for market consumption.

In this article, we look at the motion picture product category which is replete with new product launches (i.e., every new film can be considered a new product or a brand extension), and we explore the differences in movies directed by men versus women. It is not our goal to compare the financial performance of the resulting projects, which has been explored in other literature.¹⁰ Instead, we explore the differences in the types of products that male and female movie directors bring to market. In particular, we look at budgets, film length, product quality, and thematic variations. We also conduct in-depth thematic variation analysis by looking at the keywords that are used to describe movies directed by men vs. women and visualizing separate keyword networks that capture the relative prominence of different keywords as well as the way they relate to each other.

Data

We draw on a broad sample of almost 5,000 movies that had at least one keyword and a lead director listed on [Imdb.com](http://imdb.com). We also utilize subsamples ranging from 3,682 to 4,023 films released between 1991 and 2016 that had information on budget, genre, Motion Picture Association of America (MPAA) ratings, duration, and quality, as measured by critical reviews and user ratings. For example, 4,023 movies had information on duration while only 3,950 films had critical scores, and 3,751 had user ratings. Our budget

variable was even more sparse, with only 3,682 movies having corresponding production budget information. Thus, the size of the subsamples used for analysis was driven by data availability. We rely on the 1991-2016 time period due to data availability since financial performance data is sparse for earlier periods. Most of the data comes from the International Movie Database (Imdb.com), supplemented by critical and user review data from RottenTomatoes.com. We adjust the budget data for inflation using historical movie ticket prices published by the Motion Picture Association of America (MPAA).

Methods

Traditional ANOVA and chi-square techniques were used in our exploratory analysis to determine whether there were significant differences associated with films directed by male *versus* female directors. In the second part of this study, we utilized frequency and network analysis of keywords to dig deeper into thematic variations that exist in both subsamples. We opt for a force-directed network visualization algorithm¹¹ since these methods are known for producing highly effective layouts of undirected graphs (i.e., there is no directionality in node relationships) that are aesthetically pleasing and symmetrical.¹² In particular, we utilize a Fruchterman and Reingold¹³ force-directed drawing algorithm to visualize the undirected keyword network associated with movie keywords related to the male and female subsamples. In our network, the number of edges connected to the node -- i.e., the node degree -- is dictated by the number of mentions in the subsample, while the keyword co-occurrence in individual movie descriptions is indicative of the network edges. The method relies on “spring forces, similar to those in Hooke’s law...repulsive forces between all nodes, but also attractive forces between nodes that are adjacent.”¹¹ We use Gephi open source data visualization platform to calculate network parameters as well as visualize the resulting keyword networks for movies produced by male and female directors. The algorithm utilized by Gephi software is an iterative process where the overall sum of force vectors determines the direction the nodes are moved in order to minimize the energy of the entire system. Gephi has been used over the last decade primarily by engineers and data scientists for analyzing and visualizing social networks.¹⁴

The method does not produce optimal results when the number of nodes/vertices is very large. ¹¹ To address this challenge, we prune the keyword list: We only include keywords in the female subset if there are more than three occurrences, and we limit the male subsample of keywords to those nodes that appear at least ten times. The difference in the number of keywords included in each subsample is representative of the sample size

Is New Product Development Impacted by Manager's Gender?

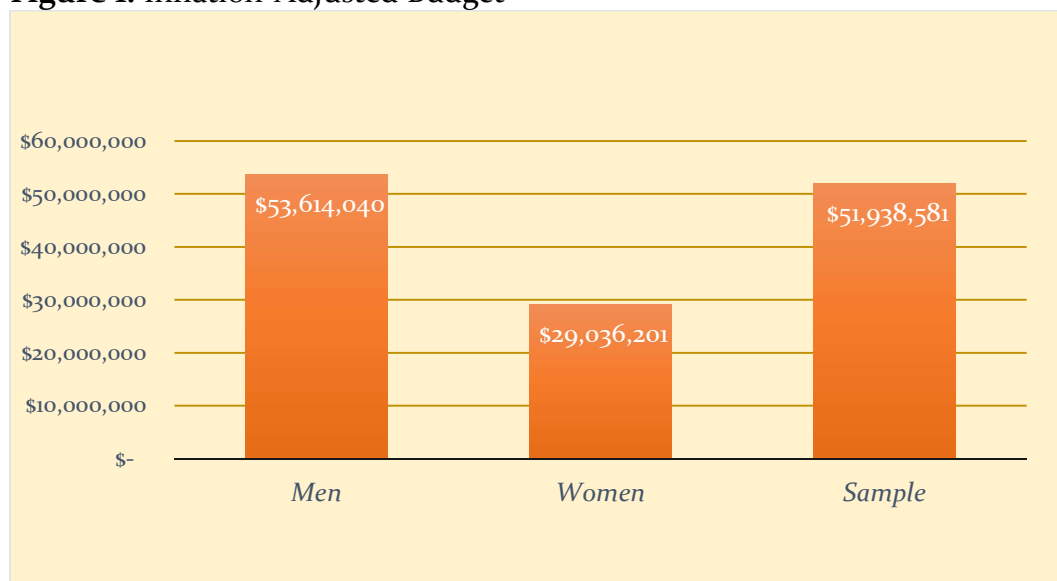
difference. These restrictions are helpful for the basic readability of the graphs and do not influence the position or salience of the major nodes. Even though numerous edges crossed each other due to the density of the network, the overall appearance of the charts produced insights regarding network centrality and the strength of relationships between the most prominent nodes.

Movie Types and Characteristics Linked to Director's Gender

Budget: According to ANOVA results movies directed by men have significantly higher budgets (see Figure 1). The inflation-adjusted budget for movies directed by men is close to \$54 million, while the estimate for movies directed by women is under \$30 million. The difference is significant at a 99% confidence level ($p < .0001$).

Movie Quality: Despite the economically as well as statistically significant differences among their budgets, ANOVA analysis revealed that there is no notable variation in the quality of movies directed by men versus women, as measured by both the critical and user reviews on Rotten Tomatoes. The critical scores were virtually indistinguishable (59.14 for men and 59.42 for women). User reviews were actually slightly higher for movies directed by women. Levene's test for equality of variances shows that variance in male versus female scores are roughly the same, and under the equal variance assumption the difference in mean user review scores (52.04 for men and 55.42 for women) is indeed significant ($p = .048$).

Figure 1. Inflation-Adjusted Budget



Is New Product Development Impacted by Manager's Gender?

Movie Duration: Analysis shows that the average movie directed by a male director is slightly longer than those directed by women ($p = .004$). The average full-length title directed by a male director was 107.28 minutes, while the average film directed by a female director was only 103.68 minutes. Further analysis revealed that this finding held after controlling for genre and the year of release.

Table 1. Genre

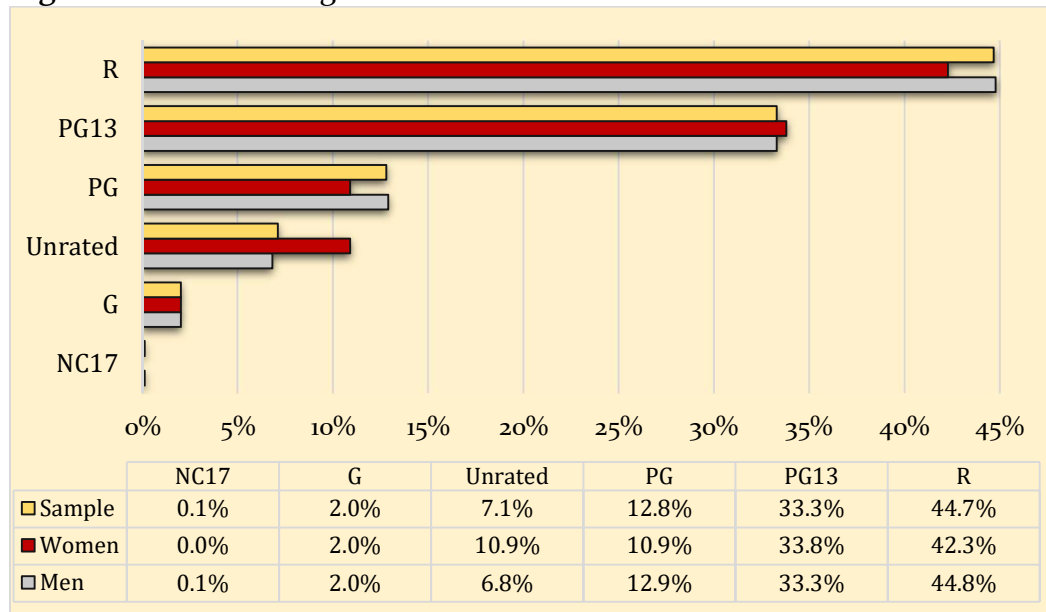
	<i>For Men Directors</i>	<i>For Women Directors</i>	<i>For Sample (Men vs. Women)</i>	<i>p-value of χ^2 test</i>	<i>Representation of films directed by women</i>
Action	98.0%	2.0%	92.7% vs 7.3%	<.001	-
Adventure	97.7%	2.3%		<.001	-
Fantasy	94.2%	5.8%		.183	Proportional
Sci-Fi	97.3%	2.7%		<.001	-
Thriller	96.6%	3.4%		<.001	-
Drama	90.5%	9.5%		<.001	+
Comedy	92.1%	7.9%		.205	Proportional
War	96.2%	3.8%		.124	Proportional
Biography	91.6%	8.4%		.488	Proportional
Documentary	83.3%	16.7%		<.001	+
Musical	86.5%	13.5%		<.001	+
Romance	88.8%	11.2%		<.001	+
History	92.4%	7.6%		.902	Proportional
Horror	96.7%	3.3%		.001	-
Crime	97.0%	3.0%		<.001	-
Animation	97.4%	2.6%		.009	-
Family	93.6%	6.4%		.430	Proportional
Sport	92.3%	7.7%		.848	Proportional

Genre: In the subsample of the movies that contained genre information, 92.7 percent of movies were directed by men, while women directed 7.3 percent (See Table 1). We looked at whether this pattern was relatively stable across movies of different genres (note that Imdb.com genre identifiers are

Is New Product Development Impacted by Manager's Gender?

not mutually exclusive). The chi-squared test indicated that, in fact, for some genres this ratio is relatively the same as the overall gender-specific split. In particular, percentages for fantasy, comedy, war, biography, history, family, and sports movies are proportional to the overall sample breakdown along gender lines. Meanwhile, the proportion of men is higher than the sample average for action, adventure, sci-fi, thriller, horror, crime, and animation movies. In comparison, the proportion of women is significantly higher than the overall sample proportion when it comes to dramas, documentaries, musicals, and romance movies.

Figure 2. MPAA Ratings



MPAA Ratings: Overall, there is a much larger proportion of movies made by female directors that are “unrated” by MPAA, suggesting that these movies have not been submitted to MPAA for a rating. It is not clear what the exact source of this variation is; however it is logical to assume that the discrepancy is due to the fact that women are directing more small scale independent movies that are not geared toward wide distribution. Also, these differences might be linked to some genre-specific variations, where movies associated with some genres are more (or less) likely to be directed by women (Table 1). For example, documentaries are not as sensitive to the lack of MPAA ratings when it comes to their niche distribution, while action and adventure movies disproportionally directed by men typically benefit from mass distribution. However, an examination of the overall breakdown of the MPAA rated movies revealed that there were no significant differences in the MPAA rating category proportions in the subsamples for men versus women.

The exact proportions of movies with different MPAA ratings by gender in our sample are presented in Figure 2.

Analysis of Keywords and Thematic Variations

We examined some thematic variations in movies directed by men versus women. Examining the raw frequency of IMDb keywords in our sample revealed that while love and friendship seem to be highly prominent topics for both genders, there were some stark differences. For example, when we examine the keyword frequencies for the male and female subsamples (Figures 3 and 4), the list of top ten keywords for the male subsample is distinguished by an emphasis on murder, death, and revenge. Drugs, prisons, police, and FBI also make an appearance close to the top of the list for male directors. In contrast, for women directors, the top ten keywords include school-related themes (school, teacher, and high school) and weddings. The topic of male nudity is also prominently featured in the movies produced by women, with two topical keywords (male rear nudity and male nudity) appearing on the list. Lesbian themes also seem to get more attention in movies directed by women. Regardless of gender, New York City serves as the favorite backdrop for all directors.

A lot of the keywords are assigned post-release, as some movies are identified as box office flops, box office hits, or cult films; i.e., the labels are more closely associated with box office performance rather than thematic characteristics. Also, 'movies directed by female' is the top keyword in female subsample which has nothing to do with film content and points to a problematic tendency of seeing 'male' directors as the norm and assigning a descriptive label to movies that do not fit this convention. While the description may be useful for people seeking out this type of movie, it suggests broad level tokenization of women directors. Consequently, we removed this label from the network analysis presented later in the paper. Even with these limitations, we can clearly see that some topics are a lot more(less) prominent.

As previously noted, murder, death, and revenge dominate the movies made by men, with some items like vomiting, aliens, and serial killers only appearing as top keywords in this subsample. While men concentrate on telling stories of writers and scientists, women are more likely to make movies that use a girl/female protagonist's perspective, base movies on true stories, and concentrate on teachers and school life.

Is New Product Development Impacted by Manager's Gender?

Figure 3. Top 30 IMDB Keywords for Titles Directed by Men

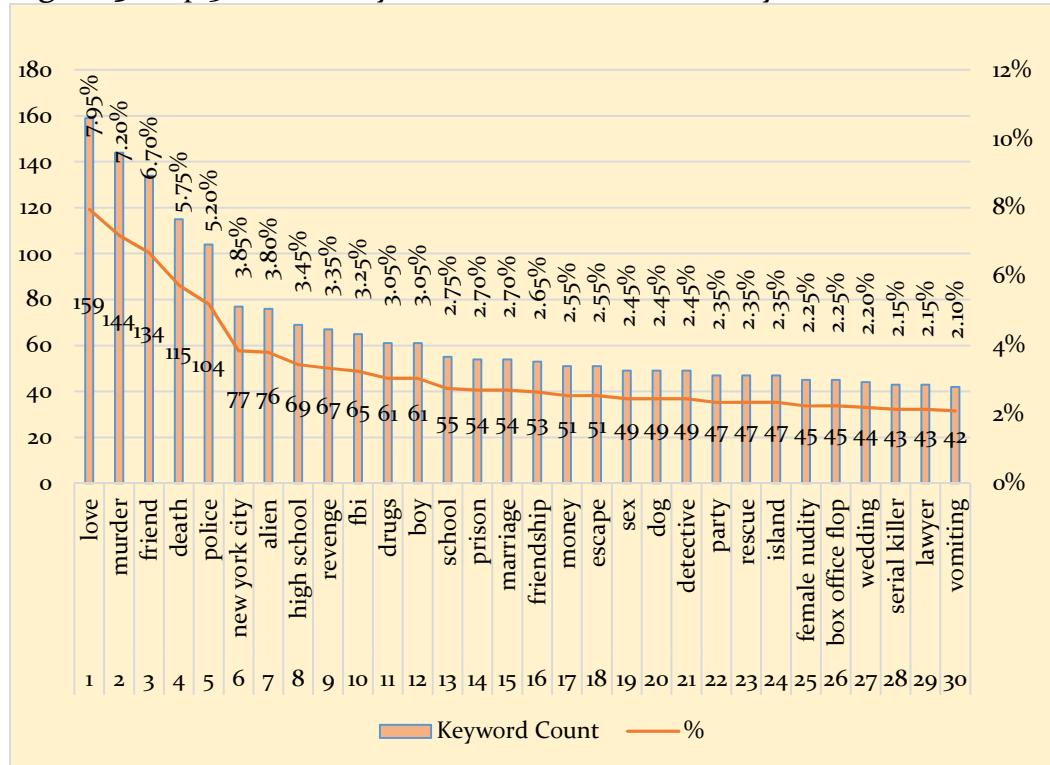
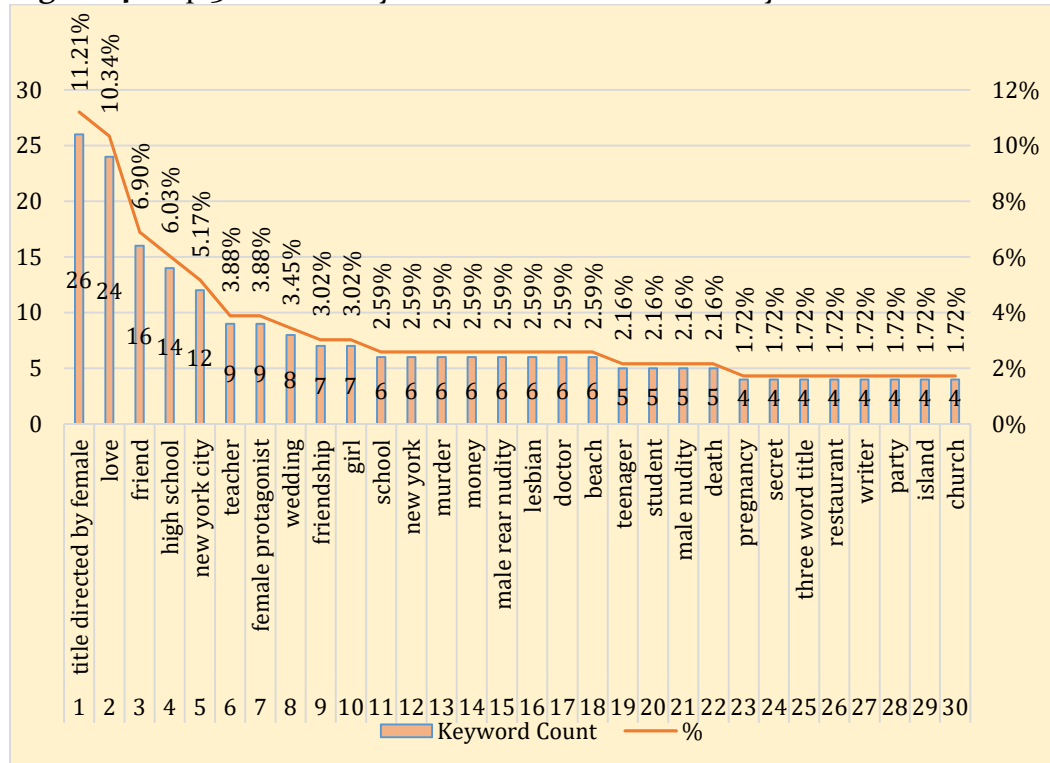
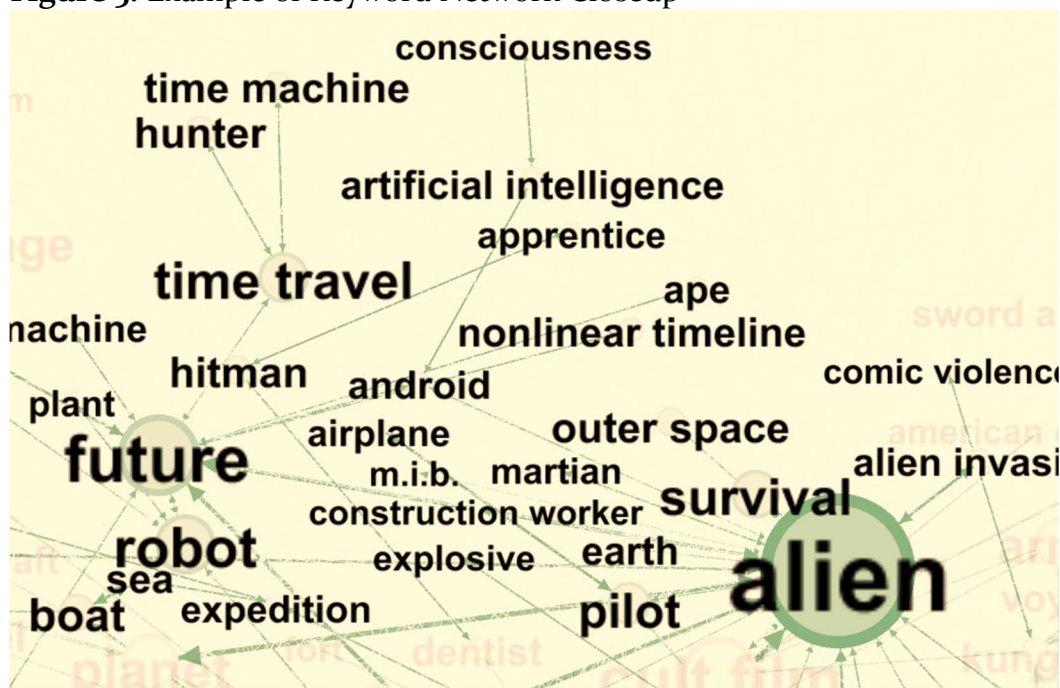


Figure 4. Top 30 IMDB Keywords for Titles Directed by Women



We also examine how these themes relate to one another. Forced Atlas¹⁵ layout in Gephi allows users to explore various network nodes and keyword relationships. Figure 5 presents one of the examples. We clearly see how certain franchises helped shape this keyword network. In some instances, some terminology related to a particular franchise even makes it onto the keyword list (e.g., “m.i.b” abbreviation made it into the alien/future cluster; we also see “hitman,” “android,” “machine,” “consciousness” terms from the Terminator franchise permanently featured in this part of the network).

Figure 5. Example of Keyword Network Closeup



Next, we use the previously described Fruchterman and Reingold approach to visualize keyword network for female (Figure 6) and male (Figure 7) subsamples and identify some central themes. Our results indicate that love is clearly the central and the most salient theme in the female-directed films. While love is also the keyword with the highest network degree within the male network, its position is not nearly as prominent; the themes of murder and death appear to be more central for the male subsample. Once again, there are some interesting clusters emerging in the male director sample that immediately evoke memories of certain movies or prominent movie franchises. There are also clusters that capture certain themes and stereotypes: a cluster that connects such terms as detective,

code trans-directors as separate categories based on gender transition type and identity. However, we do not have a sufficient sample size to do this successfully as there are some unique circumstances regarding some directors and (less frequently) director teams. For example, it was not clear to us how to appropriately code a duo of directors where one was undergoing a gender transition.

We had to make some crude simplifying assumptions by assigning directors to binary categories (at times based on gender pronouns used in press releases for less known directors) and leaving out the movies with complex gender identity circumstances. The only way to properly code gender would be to rely on self-reported gender categories. Hopefully, aggregator websites such as IMDb will add a gender identity section to directors' profiles highlighting industry participants' gender, sexual orientation, preferred pronouns, etc. and the reduction in stigma will lead people to be more open and share the multiple dimensions of their identity with their fans in the future. In the meantime, it would be worthwhile to examine non-binary, transgender, and gender-fluid director projects in a qualitative case study to avoid sample size limitation in future research.

While our analysis captures clear differences with regard to genres and keywords, we are unable to distinguish to what extent this reflects women directors gravitating towards specific genres and themes, or to what extent this reflects the possibility that women directors are frequently recruited to direct movies that include particular themes. The differences that we observe may be due to choices made by the directors themselves or could stem from the set of opportunities available to women directors. In this paper, we focus on the patterns we observe, rather than the causal paths that lead to such differences.

Conclusion and Future Research

Our analysis indicated that while men direct more ambitious projects (in terms of budget and duration), the quality level of the products developed by male versus female directors is not necessarily different, thereby suggesting that women may be more efficient in generating high-quality outcomes. While some of these differences are driven by women taking on projects that are associated with lower budgets (e.g., documentaries), it is not evident that they turn down action and adventure movies. On the contrary, industry and academic sources suggest that they may often simply be denied the opportunity to work on large scale projects. Previous studies point to a 'fiscal cliff' where women's representation drops drastically as soon as the scale of the project goes up.²⁰

We find that higher budget movies directed by men are more likely to be rated by MPAA; however, the overall MPAA ratings the movies receive do not vary significantly between genders. Nevertheless, there are significant variations among the genres of movies made by men versus women. While women are more likely to work on emotionally charged projects that rely on the quality of dialog and creativity (dramas and musicals), men are more likely to direct projects that rely on technical execution and special effects (action, adventure, thriller, sci-fi, horror, animation, etc.).

While love and friendship are central themes in movies made by both men and women, these themes are augmented by themes of murder and violence in male-directed films. Keywords such as murder, revenge, FBI, police, drugs, and serial killers are central in their work. In contrast, for movies directed by women, love is a more dominant keyword, supplemented by friendship, school, and female protagonists.

Our analysis sheds light on some of the biases in the industry that are reflected in film classification by data aggregators. For instance, we eliminated the 'title directed by female' classifier as it would have been redundant in the context of our analysis, but there is a broader discussion that needs to happen about treating "maleness" as the norm. In addition, movie titles get coded as "movies with female protagonist" because this is seen as unusual in contrast with movies with male central characters. Similar discussions are arising in a variety of different fields. For instance, Donna Strickland, the physics Nobel Laureate has spoken up against being referred to as a "woman in science".²¹ In the field of new product development, women deserve to be seen as scientists, directors, project managers, and engineers rather than 'female directors' or 'women in tech.' It is essential to have an honest conversation about this in the movie industry: While we may want to categorize these films for consumers who want to support women directors, there is a need to think of more suitable ways of doing it.

Finally, our findings indicate that there are no notable differences in the level of quality between movies directed by men vs. those directed by women, which raises additional questions about the relative dearth of Academy Award nominations for female directors.²² Since there are no differences in the viewer and critical ratings of male- vs. female-directed films, one must look at the lack of distribution and advertising support for female-directed features since these factors lead to their reduced visibility. It may also be useful to examine the composition of the voting members of the Academy or their potential implicit biases in order to gain some understanding of the reasons why there have been so few women directors being nominated in the Best Director category, i.e., since the Oscars' establishment over 90 years ago, only one woman, Kathryn Bigelow, has won an Academy Award in the Best

Is New Product Development Impacted by Manager's Gender?

Director Category back in 2010 and only four more earned a nomination. Lack of formal recognition and relegation to a niche category are commonplace, and given the parity of movie quality outlined in this paper, the industry needs to do more when it comes to removing the barriers facing women directors.

Authors

*Kate Karniouchina is the Dean of Lorry I. Lokey School of Business and Public Policy. Kate holds a PhD in Marketing, an MBA, and a BA degree in Finance from the University of Utah. Her work has been widely published in academic and industry journals including the Journal of Marketing, Strategic Management Journal, International Journal of Research in Marketing, Journal of Product Innovation Management, Cornell Hospitality Quarterly, Marketing Letters, Journal of Service Management, and European Journal of Operational Research. She is a marketing research expert who carries out projects for a number of small business, corporate and government clients.
email: kkarniouchina@mills.edu*

*Carol Theokary is an Associate Professor of Business at Mills College. She holds a Doctorate in Business Administration from Boston University and has extensive working experience in network design in the telecommunications field. Carol's research interests lie broadly in empirical modeling across sectors including healthcare operations, service management, and entrepreneurship. Her recent work has focused on understanding the dynamics of crowdfunding and the drivers of success of social media influencers. Her research has appeared in numerous publications, including Production and Operations Management and Medical Care Research and Review. At Mills, she teaches various courses such as operations management and quantitative methods, and is passionate about creating a learning environment that engages students in the subject matter.
email: ctheokary@mills.edu*

*Lorien Rice is a Professor of Economics at Mills College. Before joining academia, she completed her PhD in Economics at UC San Diego, and worked as a Research Fellow for the Public Policy Institute of California. Dr. Rice's work has focused on identifying barriers to equality in access to education and jobs. She has investigated inequalities in resources and outcomes in the public schools, looking at differences by race and gender. She has also studied the effects of school choice programs on racial integration, and the demographics of voter support for integrative student assignment systems. Her research on transportation has measured the effect of car ownership and public transportation quality on the probability of being employed. Prior to graduate school, she worked for MDRC in New York evaluating government programs, and she served as a Peace Corps volunteer in Morocco as a socio-economic planner.
email: lrice@mills.edu*

Can Usley is an Associate Professor and the Vice Dean for Academic Programs and Innovations at Rutgers Business School, Newark and New Brunswick. He received his MBA and Ph.D. from the Georgia Institute of Technology. His research interests lie broadly within marketing strategy and theory construction. He is a recipient of the Chancellor's Award, the Valerie Scudder Award, and several Dean's awards for outstanding scholarship, teaching, and service. His research has been presented in various international conferences and published in the leading academic journals such as the *Journal of Marketing*, *Journal of the Academy of Marketing Science*, *European Business Review*, *International Business Review*, *International Journal of Technology Management*, *International Journal of Business Environment*, *International Journal of Quality & Reliability Management*, *Journal of Advertising Education*, *Journal of Business-to-Business Marketing*, *Journal of Business Research*, *Journal of Business Strategy*, *Journal of Public Policy & Marketing*, *Journal of Research in Marketing & Entrepreneurship*, *Journal of Strategic Marketing*, *Marketing Education Review*, *Review of Marketing Research*, and the *Rutgers Business Review*.

email: can.usley@business.rutgers.edu

Siobhan Reilly is a Professor of Economics at Mills College. Previously, she served on the Economics faculty at Vanderbilt University, as an analyst for Banque Paribas in Brussels, and as a consultant to the World Bank. She holds a Ph.D. in Economics from the University of California at Berkeley, and an M.A. in International Affairs, with a concentration in African Studies, from the Paul H. Nitze School of Advanced International Studies (SAIS) of the Johns Hopkins University. Siobhan's research centers on the distribution of resources through non-market mechanisms, focusing on the effects of program design, family law, and intra-household resource allocation on gender equity and family wellbeing. Her published work spans an array of topics including income inequality, welfare programs, child support guidelines, divorce law, family complexity, and the effects of breastfeeding.

email: sreilly@mills.edu

Endnotes

1. Pascual-Miguel, F.J., Agudo-Peregrina, Á.F., & Chaparro-Peláez, J. (2015). Influences of gender and product type on online purchasing. *Journal of Business Research*, 68(7), 1550-1556.
2. Richard, M.O., Chebat, J.C., Yang, Z., & Putrevu, S. (2010). A proposed model of online consumer behavior: Assessing the role of gender. *Journal of Business Research*, 63(9-10), 926-934.
3. Simon, S.J., & Peppas, S.C. (2005). Attitudes towards product website design: A study of the effects of gender. *Journal of Marketing Communications*, 11(2), 129-144.
4. Paek, H.-J., Nelson, M.R., & Vilela, A.M. (2011). Examination of gender-role portrayals in television advertising across seven countries. *Sex Roles*, 64, 192-207.
5. Matthes, J., Prieler, M., & Adam, K. (2016). Gender-role portrayals in television advertising across the globe. *Sex Roles*, 75, 314-327.

Is New Product Development Impacted by Manager's Gender?

6. Odekerken-Schröder, G., De Wulf, K., & Hofstee, N. (2002). Is gender stereotyping in advertising more prevalent in masculine countries? A cross-national analysis. *International Marketing Review*, 19(4), 408–419.
7. Grohmann, B. (2009). Gender dimensions of brand personality. *Journal of Marketing Research*, 46(1), 105–119.
8. Landreth Grau, S. & Zotos, Y.C. (2016). Gender stereotypes in advertising: a review of current research. *International Journal of Advertising*, 35(5), 761–770.
9. Stevens, J.L. & Shanahan, K.J. (2017). Structured abstract: Anger, willingness, or clueless? Understanding why women pay a pink tax on the products they consume. In M. Stieler (Ed.), *Proceedings of the 2016 Academy of Marketing Science (AMS) Annual Conference*. Springer International Publishing.
10. Karniouchina, E.V., Theokary, C., Rice, L., & Reilly, S. (2019). *Movie director gender: Resources, reviews, and revenues*. Presentation at Mallen 21 Conference, Los Angeles, CA.
11. Tamassia, R. (Ed.). (2013). *Handbook on graph drawing and visualization*. CRC Press.
12. Kobourov, S. (2012). Spring Embedders and Force Directed Graph Drawing Algorithms. *ArXiv*.
13. Fruchterman, T.M.J., & Reingold, E.M. (1991). Graph drawing by force-directed placement. *Software – Practice & Experience*, 21(11), 1129–1164.
14. Bastian, M., Heymann, S. & Jacomy, M. (2009). *Gephi: An open source software for exploring and manipulating networks*. Proceedings of the Third International Conference on Weblogs and Social Media, San Jose, CA.
15. Jacomy, M., Venturini, T., Heymann, S., & Bastian, M. (2014). ForceAtlas2, a continuous graph layout algorithm for handy network visualization designed for the Gephi software. *PLoS ONE*, 9(6), e98679.
16. Monro, S. (2005). Beyond male and female: Post structuralism and the spectrum of gender. *International Journal of Transgenderism*, 8(1), 3–22.
17. Richards, C., Bouman, W.P., Seal, L., Barker, M.J., Nieder, T.O., & T'Sjoen, G. (2016). Non-binary or genderqueer genders. *International Review of Psychiatry*, 28(1), 95–102.
18. Losty, M. & O'Connor, J. (2018). Falling outside of the 'nice little binary box': a psychoanalytic exploration of the non-binary gender identity. *Psychoanalytic Psychotherapy*, 32(1), 40–60.
19. VanDerWerff, E. (2019, March 30). How The Matrix experience universalized a trans experience – and helped me accept my own. *Vox*.
20. New USC Annenberg research reveals 'fiscal cliff' women directors face in commercial filmmaking. (2015, April 24). *USC Annenberg*.
21. McBride, J. (2018, October 20). Nobel laureate Donna Strickland: 'I see myself as a scientist, not a woman in science.' *The Guardian*.
22. How could the Oscars ignore these brilliant women directors? (2020, January 13). *BBC*.