Gender Bias in Idea Generation and the Evaluation of Creative Ideas: An Online Behavioural Experiment

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Abstract: Generating and selecting profitable ideas to solve complex problems, is essential to entrepreneurship. However, such choices are heavily influenced by personal bias. Entrepreneurship is framed as a "masculine world" (Bird and Brush, 2002). Entrepreneurs rely heavily on creativity, risk-taking and divergent thinking which are deemed to be predominantly masculine traits (Cropley, 2006). The majority of investment decision-makers are also male (Brush et al., 2018). Investors are critical in determining whether an idea will be further developed. The compounding effect is the inequitable distribution of funding and low rates of success for female founders. A significant factor in the divergence of treatment between men and women entrepreneurs is gender bias. However, we believe that innovative ideas are also gendered and that this is what influences selection. We conducted experiments to understand the impact of gender bias in creative group processes when using the divergent-convergent (diamond) approach for ideation. Our aim was to explore whether individuals selected ideas due to the creator's identity or whether ideas perceived as "feminine" or "masculine" influences choice. Furthermore, we examined whether males were more creative and produced more divergent ideas than females. Using an electronic brainstorming system (EBS) we engaged 230 innovation and entrepreneurship university students in vignette-style ideation and evaluation challenges. Results showed no significant differences between genders in creativity, novelty, or usefulness ratings. However, "feminine" ideas were rated higher by females on all (but one) criteria and males rated "masculine" ideas higher on all criteria. Our results demonstrate a sex-based preference for gendered ideas in both sexes. Females were rated higher on divergent ideas and males higher on convergent ideas, which conflicts with the established view of male dominance. The experiment showed that the EBS system mitigated social cues around identity and reduced the impact of gender bias on creative evaluation. This research raises concern about investment in innovation and whether "masculine" preferred solutions are inevitable in a male-dominated funding environment. This research contributes to an understanding of the influence of finance on the success of economic or profit-focused innovations (masculine) as opposed to those that address social outcomes or community good (feminine).

Keywords: social entrepreneurship; gender bias; design-led innovation; decision-making, sex-role attributes

1. Introduction

Most innovation requires funding and support for the further development and experimentation of ideas. Innovative ideas are conceived by entrepreneurs who, through resourcefulness, nous, and business ingenuity, develop and market their solution. The first step in this difficult journey is often identifying and commissioning finance. The global Covid-19 pandemic highlighted a strong gender-based bias in funding for entrepreneurs. In 2020, female entrepreneurs received only 2.3% of available global venture capital funding (Bittner and Lau, 2021) and were 20% more likely to report a business closure due to the pandemic (Kelly and Majbouri, 2021). Funding sources were predominantly male, with only 5.8% by female investors compared to 8.2% of males (Kelly and Majbouri, 2021).

There are several factors that have produced such a startlingly unbalanced playing field. The most significant factor in the gender funding gap is bias against women in terms of selection or evaluation of ideas (Brush and Greene, 2014). Research shows that during times of economic pressure, investors systematically perceive female entrepreneurs as less attractive for investment opportunities in comparison to their male counterparts (Bigelow et al., 2014). Investment decisions are influenced by stereotypes aligned to characteristics associated with the different genders. such as "competence and warmth" (Fiske et al., 2002) or "credibility and competence" (Bigelow et al., 2014). Stereotypes or bias create the perception that investing in women-led enterprises is riskier. Other research showing under-representation of women as entrepreneurs, focuses on poor entrepreneurial education (Wilson et al., 2007), social expectations (García and Welter, 2013), traits and image

(Gupta et al., 2014), communication (Bird and Brush, 2002) and self-efficacy (Mueller and Dato-On, 2008) which either lead to reduced support or lower intention in females to undertake business ventures.

Feminine stereotyped behaviours lower investor evaluation of venture pitches (Balachandra et al., 2019) and entrepreneurial growth expectations (Martiarena, 2022). Feminine characteristics also trigger stereotyped threat response (Steele et al., 2002) which reduces female performance. Conversely, women who display masculine traits are perceived negatively and experience backlash or roadblocks according to role congruity theory (Eagly and Karau, 2002). However, research shows women are as capable as men in all aspects of entrepreneurship, having the skills or human capital to recognise and develop potential opportunities (Detienne and Chandler, 2007).

Stereotypes of entrepreneurial characteristics goes beyond basic gender bias. Fisk et al (Fiske, Cuddy, Glick, & Xu, 2002) illustrated how bias and stereotypes are closely aligned to characteristics displayed rather than gender. Their model showed two influential dimensions of "competence" and "warmth" as primary determinants of stereotypes. These characteristics are similar to many other researchers' descriptions in perceptions research such as Asch (1946) cold-warm, competence related (Hamilton and Fallot, 1974) and personality traits (Lydon et al., 1988). Researchers (Dimitriadis et al., 2018) found that "Agreeableness", "Openness to Experience", "Conscientiousness", and "Extraversion" were positively associated with creativity. Entrepreneurs are believed to be more creative if they model these 'masculine' traits.

The performance of women entrepreneurs are also evaluated on 'masculine' success criteria which does not apply to all types of entrepreneurship (Yousafzai et al., 2022). Social entrepreneurs are often less concerned with profit and wealth than overall social good and the outcome of their venture (Zahra et al., 2009). Social entrepreneurs are motivated by many diverse and interrelated objectives not associated with traditional or commercially driven entrepreneurship. Largely, social entrepreneurs are women and they generate considerable social value and change in parts of the world such as Pakistan, India, Africa and Sri Lanka (Zahra et al., 2009). In these sectors women are also involved heavily in micro-entrepreneurship which is also devalued against the profit-wealth success criteria (Zahra et al., 2009).

1.1 The role of bias in selection of creative ideas

Bias undermines the creative process as well as the successful implementation of any innovation. Bias in the creative process negatively impacts group creativity. In groups, the most common ideas are often shared because these will be the ones most likely accepted by all (Abele and Stasser, 2019). There are many examples of bias exhibited when people work together to solve problems such as groupthink (Grohowski et al., 1990, Kim, 2018), social loafing/free riding (Coursey et al., 2018), the ideator's own bias (Fuchs et al., 2019), insight bias (Lucas and Nordgren, 2022), ownership bias (Zheng and Miller, 2019) and self-censorship (Williams, 2002). Participants in group processes may also be biased towards self-generated concepts or other salient viewpoints and may prefer conventional ideas due to the associated risk with new ideas (Toh and Miller, 2016). Evaluation of creative ideas is also influenced by emotions. People who are in a positive mental frame are more likely to rate all ideas (both creative and non-creative) higher (Mastria et al., 2019).

Creative evaluation is fraught with subjectivity and biases due to people's poor understanding of creativity and a lack of clear evaluation criteria. For instance, Elsbach et al. (2003) found experts in Hollywood used behavioural and physical cues to match pitchers with a variety of prototypes in their head, while Mueller et al. (2018) found that decision-makers rely on social approval cues to assess ideas. In both cases, the cues the assessors draw on have little or no relationship to the quality of the ideas per se.

Research has also shown assessment of creative ideas can be heavily influenced by decision makers personal preferences (Mueller et al., 2018). The usefulness or value of an idea is closely related to social approval and economic mindset: a tendency to prioritise concerns at the heart of economics such as accuracy, rationality and self-interest rather than potential novelty or originality (Molinsky et al., 2012). Social context and approval cues have a significant influence on the evaluation of creative ideas causing highly valuable (and desirable) ideas to be downgraded due to a lack of alignment with a decision maker's views. Decision makers tend to reject financially uncertain ideas or innovations, which are often more creative (Huang and Wu, 1994).

1.2 Why is understanding and negating bias in creativity evaluation important?

Creativity is essential for innovation (Amabile, 1988), is a fundamental dimension of entrepreneurship (Fillis and Rentschler, 2010) and is seen as being as one of the most important skills of the future (Lombardo, 2010). Solving the great and complex problems of the world, requires creativity.

However, creativity is ascribed primarily to men, even when women have produced identical output (Luksyte et al., 2018, Proudfoot et al., 2015b). Gender based stereotypes of creative capability significantly impede the progress of female creators and innovators. The rejection, dismissal or undervaluing of ideas from women, means opportunities lost or significant delays in urgent solutions for complex problems. Prejudice reduces creativity and the progress of innovation (Rasch and Hain, 2017). Furthermore, perceived creativity rather than actual creativity, is increasingly rewarded in the corporate world. Proudfoot et al. (Proudfoot et al., 2015b), show that it is society's layman understanding of creativity, that determines whether an individual or their idea is deemed creative, not by a true measure of creative utility. Given characteristics ascribed principally to men such as "daring", "autonomy" and "self-direction" (Proudfoot et al., 2015b) are apparent signals of creativity, then the corporate world is simply valuing and rewarding men for being male. Providing clarity and unbiased evaluation of creativity is necessary to uncover authentic innovation and to stop a self-reinforcing system feedback loop based on prejudice.

A systematic review of the literature revealed no consistency of the impact of gender on creativity (Nakano et al., 2021). Most of the research into assessing creative capability used self-reporting psychological instruments (such as surveys) and did not assess the actual performance of creative tasks (Nakano et al., 2021). Despite the abundance of research into the subject of creativity, there is no evidence of dominance of capability between men and women (Baer and Kaufman, 2008).

1.3 Our research and hypothesis

Although research clearly demonstrates gender bias in entrepreneurship, little is known about strategies to mitigate bias in assessment of creativity and ingenuity. Research in a variety of fields show few effective approaches. Attempts to reduce gender bias through training, has been shown to have little success (Dobbin et al., 2007). One tactic has been shown to offer counter-stereotypical effect in an employee recruitment scenario, in which assessors evaluate people jointly rather than separately, but its effect has not been examined in a creativity context (Bohnet et al., 2016). Blind reviews to reduce cues have yielded poor results, and in some cases worsened the effect (Tricco et al., 2017). The use of structured free recall (SFR) has been shown to have some positive effects on the evaluation of female leaders, even with individuals that held strong explicit stereotypes (Anderson et al., 2015).

Removing names for identification of gender has potential in reducing bias in evaluation. In an experiment to assess the impact of unconscious gender bias in the review of six academic articles written by both man and women, where the article appeared to be written by a man, they were evaluated as better crafted (Goldberg, 1968). Alternatively, an experiment conducted with students to evaluate female advertising executives in a predominantly male environment, researchers removed the first name of the person being assessed to prevent cues on gender (Roca et al., 2016). The results showed no significant difference in the evaluation of creative outcome between genders. Measures that seek to reduce social cues and remove signalling may provide solutions that improve equity in evaluation, support and funding.

Building on the research on gender biases in creativity evaluation (Luksyte et al., 2018, Proudfoot et al., 2015b) we seek to clarify and measure difference in evaluation of creativity between genders as well determine the role of feminine and masculine traits in creativity. Our study focuses on the following questions:

- Are ideas proposed by females rated less than those proposed by males in terms of creativity?
- Do *novelty* and *usefulness* carry different weights in the evaluation of males' and females' creativity?
- Are females rated less when the problem is perceived to be "masculine"?
- Is there a difference in the evaluation of "feminine" versus "masculine" ideas by the genders?
- Are ideas proposed by males more divergent?

Creativity is believed to be comprised of two dimensions: novelty and usefulness (Amabile, 1988, Amabile, 1982, Amabile, 1983, Sarkar and Chakrabarti, 2011, Harvey and Berry, 2022). Studies examining the two dimensions separately have yielded useful insights (Sue-Chan & Hempel, 2016). However, it is not known whether the two dimensions will weigh the same in the evaluation of males' and females' creativity and whether females' creativity will be downgraded in both aspects and be penalized in one aspect more than another. We used the existing measures of creativity (Sue-Chan & Hempel, 2016) and the conceptualisation of divergent-convergent thinking as discussed by Proudfoot et al. (2015b) to explore the research questions.

2. Research design

2.1 Method

We developed an online experiment where individuals participated in a complete creative process of idea generation, expansion, integration and evaluation. Participants interacted with SparkTank [an electronic brainstorming tool (EBS)] during a facilitated workshop. SparkTank uses the divergent-convergent process from design thinking and enables individuals or groups to participate in ideation in a digital environment.

Participants were invited to register, create a profile and then engage in an idea generation session on the platform. Participants selected an avatar to represent their gender (colour coded). The process involved a facilitator directing ideation simultaneously for the whole group through a "control room" screen which 'pushed' each step of the idea generation process to participants. Each participant was encouraged to submit as many ideas as possible within a set time to address the challenge question. When the time had elapsed, the platform randomly reassigned ideas to other people to extend or improve. The process used the "Yes, and…" method used in theatre improvisation. When the time allocated for this step had elapsed, the facilitator activated the third step in the process. Each participant was shown their original ideas along with the additions or suggestions from other participants. Each participant was given the opportunity to reshape and submit final ideas. When the time for this step elapsed, the facilitator activated the last step in the process. Each person was randomly assigned completed ideas (displaying the contributions from other participants) to be evaluated on our criteria. The platform used the scores from the criteria to provide an overall rating. The rating given to each idea was shown as a percentage. Finally, participants were shown the leaderboard with all ideas scored.

2.2 Procedure

A "feminine" and a "masculine" challenge were conducted online using Zoom video conferencing concurrently with SparkTank. A sample of students (n=230) were invited from the University of Queensland courses (EIBS7300 Creativity and Innovation Design and TIMS1301 Entrepreneurial Mindset & Idea) to participate. To foster commitment, the task was integrated in the university course offering and details were explained to students in class. The experiment was conducted between April and August 2021. The feminine challenge (Figure 1) was on the topic of sustainable fast fashion (Fast Fashion) and the masculine topic, a sustainable football talent pipeline (Football Pipeline). We used the definition of masculine and feminine by Proudfoot et al (2015b, 2015a) and Prentice and Carranza (2002), a *masculinized orientation* being: agentic, independent, distinctive, intelligent, decisive, competitive, self-reliant, willing to take risks, ambitious, daring, adventurous, courageous; and a *feminine orientation* being interconnectedness, harmony, communal, sensitive, cooperative, understanding of others, helpful to others, sympathetic, nurturing, warm in relations with others, and supportive. Each challenge took approximately 30 minutes.

Fashion problem and a solution
How do we create a planet-friendly sustainable approach to fast fashion in the future?
Description of the problem:
The term 'fast fashion' has become more prominent in conversations surrounding fashion, sustainability and environmental consciousness. The term refers to 'cheaply produced and priced garments that copy the latest catwalk styles and get pumped quickly through stores in order to maximise on current trends'. The fast fashion model is a system involving rapid design, production, distribution and marketing, which means that retailers are able to pull smaller quantities of greater product variety and allow consumers to get more fashion and product differentiation at a low price. Fashion production has a massive impact on global emissions (10% global emissions are due to fashion). The production of fashion uses water, pollutes rives and increases landfill through waste.
Fast fashion however, has made it possible for all people to wear clothes that match the latest trends. For many people this provides a means of crossing cultural, class or socio-economic barriers. As clothing has become cheaper, people with low income are able to enjoy the thrill of buying something that they want and not have to sacrifice purchases in comparison to basic living expenses. Fast fashion is successful for many reasons such as: shopping is fun; fast fashion is affordable; many style choices; and its available everywhere.
(Read more here: https://earth.org/fast-fashions-detrimental-effect-on-the-environment/)

Who is impacted: consumers with low to medium income, because they can have things that they could not normally afford.

Assumptions:

1. That fast fashion is environmentally unsustainable
2. That fast fashion is cheap
3. That fast fashion is convenient
4. That environmentally sustainable fashion is more expensive
5. That environmentally sustainable fashion is often not "on trend"

Focus areas:
Social identity and behaviour
What solutions can you provide that provide sustainable approaches to fashion, but still cater to individual need to respond to latest trends, enjoy creating an individual identity, the thrill of looking good and the fun of shopping.

Accessibility and affordability
What solutions can you think of that will make fashion affordable, accessible and available for all people whilst still being sustainable?

Figure 1: Vignette of challenge on "Fast Fashion Sustainability"

The evaluation criteria for assessment were adapted from Sue-Chan and Hempel's (2016) exploration of the factors of creativity (novelty and usefulness). Novelty and usefulness are a multiplied measure and are therefore believed to only produce creativity if both factors exist (greater than zero) (Sarkar and Chakrabarti, 2007).

Table 1: Measures of novelty, usefulness and creativity

Independent variables		
Factor	Description	Scale
Novelty	A fresh approach was taken to solve the problem	(Disagree 1 – agree 5)
Novelty	The solution is out of the box	(Disagree 1 – agree 5)
Novelty	The solution to the problem is unprecedented	(Disagree 1 – agree 5)
Novelty	The solution is different from traditional ways of doing things	(Disagree 1 – agree 5)
Usefulness	Other contributor's ideas are combined in a constructive manner	(Disagree 1 – agree 5)
Usefulness	The solution focused on the needs of the user	(Disagree 1 – agree 5)
Usefulness	The solution develops adequate plans for the implementation of new ideas	(Disagree 1 – agree 5)
Usefulness	The solution identifies opportunities for its implementation	(Disagree 1 – agree 5)
Dependent variables		
NOVELTY	How original and practical is the solution? – Original and practical solutions are both totally unique and especially useful	(1 Not very original and practical – 5 very original and practical)
USEFULNESS	How adaptive and practical? Adaptive and practical solutions use existing information or materials to develop ideas that are useful	(1 Not very adaptive and practical – 5 very adaptive and practical)
CREATIVITY	How creative is this solution? Creativity refers to the extent to which the solution is both original and useful	(1 Not very creative – 5 very creative)

3. Analysis

For the *Fast Fashion* challenge, a total of 284 ideas were generated, the *Football Pipeline* challenge generated 217 ideas. Out of those, 148 in the *Fast Fashion* challenge (52%) and 125 (57%) ideas were retained. Incomplete data, meaning the ideas were not rated by at least 3 other students and/or the gender of their author was missing and could not be reassigned, was discarded. In the Fast Fashion challenge females contributed 44% of the ideas and males 56%. For the *Football Pipeline* challenge females contributed 47% of the ideas and males 53%.

The data was coded and interrogated in several different ways. Firstly, all ideas at every step were open coded (in NVIVO) according to theme over several passes of the data and cross checked amongst the research team to ensure consistency. Concurrently, each integrated final idea was coded by three researchers according to whether it was considered a masculine or feminine idea as well as on the divergent-convergent criteria. The thematic coded data from NVIVO was then merged with the screened data file that included the systematic coding for masculine-feminine ideas and the convergent-divergent codes. All descriptives and frequencies were checked to ensure no further missing data.

4. Results

ANOVAs were conducted to determine difference in ratings on all 11 creativity criteria according to gender. In both the *Fast Fashion* and the *Football Pipeline* challenge there were no significant difference in the ratings in on the usefulness, novelty, and creativity factors, according to gender. There were also no differences in overall individual creativity scores for either males or females.

ANOVAs were also conducted on all ideas according to the masculine-feminine dimensions, revealing several significant differences. Ratings provided by males were compared with ratings provided by females on masculine and feminine coded ideas. Generally, males rated higher than females on all criteria across both challenges. Where ideas were classified as gendered, females rated feminine ideas higher than males and males rated masculine ideas higher than females. The difference in rating patterns was more pronounced in the *Fast Fashion* challenge.

Analysis of the differences in means between male and female ideas according to the divergent-convergent criteria showed inconsistent ratings across the two challenges.

In the *Fast Fashion* (feminine) challenge, females scored highest scores for divergent thinking on overall creativity as well as the two factors: novelty and usefulness with the *Thinking out of the box* criteria for divergence. Males were also significantly higher on the convergent criteria *Building on tradition* across all factors. However, females were rated higher than males on the convergent criteria *Bringing perspectives together* and males were rated higher across all factors in the *Adopting a perspective distinct from others* (divergent) criteria.

In the *Football Pipeline* challenge, males scored highest on two different set of convergent criteria: *Following what others have done* and *Connecting the dots.* Females scored higher on two divergent criteria in the novelty factor *Thinking outside the box* and *Disregarding tradition.* In both challenges, females rated higher on divergent criteria and males rated higher on convergent criteria.

4.1.1 Fast Fashion challenge results

On all but one characteristic, males rated masculine ideas higher than females (Figure 2). Similarly, females rated 6 of the 12 characteristics higher than males on feminine ideas. Where ideas were coded as "neutral" (neither male nor female), four questions had significant difference in ratings between genders. Each of the questions were rated higher by males.

4.1.2 Football Pipeline challenge results

In the Football Pipeline challenge, ratings for masculine ideas showed no difference between genders on seven of the 11 criteria (Figure 3). However, males rated masculine ideas on three criteria and females rated masculine ideas higher on one criterion: *This solution identifies opportunities for its implementation*. Feminine ideas were also mostly rated higher by males (Figure 3).

4.2 Differences in rating according to divergence-convergence

The divergent-convergent ratings showed significant differences between males and females across the two challenges. ANOVAs were conducted across all the individual variables as well as on the total overall rating. The two tables below summarise the highest ratings according to gender on the divergent and convergent criteria. ANOVAs were also conducted on the novelty, usefulness and creativity scores. Divergent ideas were rated higher than convergent ideas on all divergent-convergent pairs except the *Adopting a perspective distinct from others – bringing perspectives together*, where convergent ideas were rated higher.

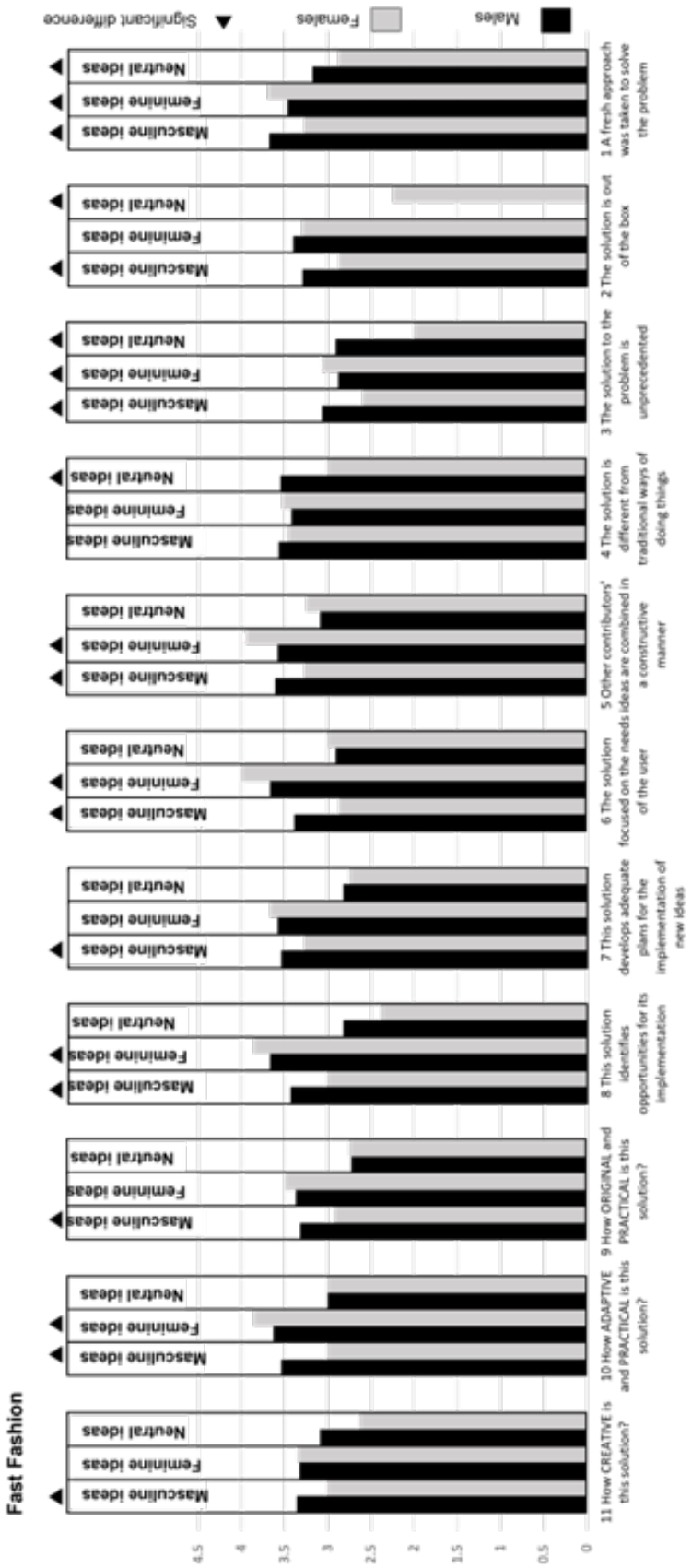

Figure 2: Fast Fashion results across all creativity criteria

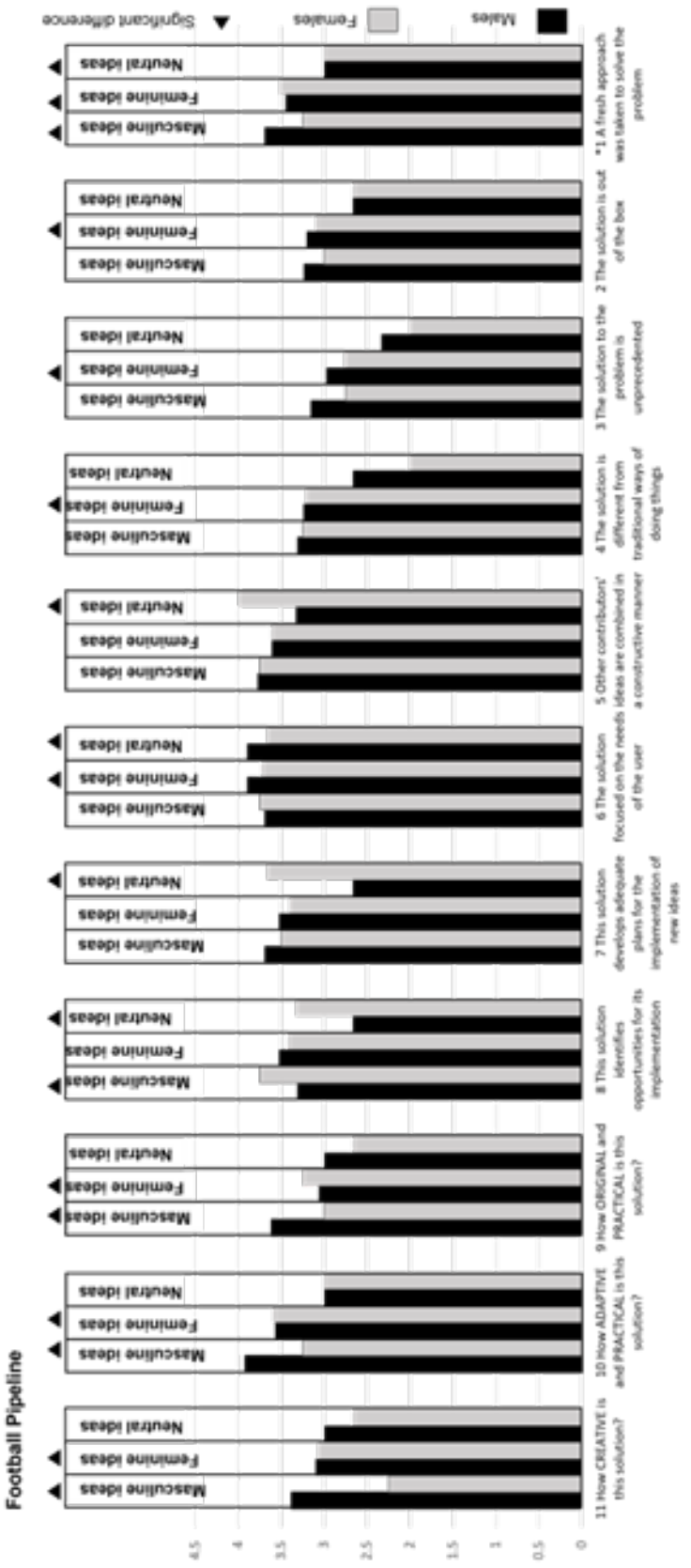

Figure 3: Football Pipeline results across all creativity criteria

Table 2: Highest rated gender on the divergent-convergent criteria Fast Fashion

Divergent-convergent pairs	Usefulness	Novelty	Overall creativity
Thinking outside the box (divergent)	female	female	female
Connecting the dots (convergent)	X	male	male
Disregarding tradition (divergent)	X	X	X
Building on tradition (convergent)	male	male	male
Going against what others have done (divergent)	X	male	X
Following what others have done (convergent)	X	X	X
Adopting a perspective distinct from others (divergent)	male	male	male
Bringing perspectives together (convergent)	female	X	X

X indicates no significant difference between ratings

Table 3: Highest rated gender on the divergent-convergent criteria Football Pipeline

Divergent-convergent pairs	Usefulness	Novelty	Overall creativity
Thinking outside the box (divergent)	X	females	X
Connecting the dots (convergent)	X	male	male
Disregarding tradition (divergent)	X	female	X
Building on tradition (convergent)	X	X	X
Going against what others have done (divergent)	X	X	X
Following what others have done (convergent)	male	male	male
Adopting a perspective distinct from others (divergent)	male	X	X
Bringing perspectives together (convergent)	X	X	male

X indicates no significant difference between ratings

5. Discussion and conclusion

Our results show no apparent gender-bias in generating and evaluating novelty, usefulness or creativity of an idea when using an EBS. Both the feminine and masculine challenges had an equivalent number by proportion, of masculine and feminine solutions. Even though we asked participants to associate a gendered avatar to their identity as a form of social signalling, this did not have any discernible effect on the ratings people gave to other's ideas for creativity scores. The use of a digital tool, where participants were all remotely participating in the ideation process, reduced or mitigated any stereotyped gender associations with ideas. Technology has potential to remove social cues that create stereotypes and influence perceptions of innovative ideas.

Females and males also had similar distributions of scores across all factors. Therefore, neither males nor females were shown as having dominant creative capability. However, the process did reveal a distinct preference for females to rate "feminine" ideas higher, and males to rate "masculine" ideas higher when the challenge was "feminine" despite the gender of the idea creator. The *Football Pipeline* challenge results showed higher ratings by males on both feminine and masculine ideas. The higher ratings on all factors reveal males appeared less discerning than females and had different standards when evaluating creativity.

Results also showed ideas created by females were rated higher on divergence and males higher on convergence criteria in both challenges. This result challenges the firmly held belief that men are more divergent in their thinking and are therefore more creative (Proudfoot et al., 2015b). Men may be *perceived* as being more divergent in their thinking, but the experiment showed that females produced more ideas that were divergent, and thus potentially more creative.

Creative performance, such as ideation is not dominated by either gender. However, stereotypes and unconscious bias impact evaluation of ideas at a fundamental level. Ideas themselves are "feminine" and "masculine" and therefore may be evaluated differently depending on the framing of the challenge. The results in our research, raise a fundamental question about how we value attributes or characteristics associated with masculinity or femininity and how these contribute to our view of "best" solutions. Our research contributes to understanding the impact of bias on the effectiveness and selection of innovations as well as problem solving for the greater good.

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