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Social interactions in different environments impacts and motivates reproductive displays in college students

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Abstract

Social environments can have an impact on the interactions between the sexes, specifically pre-courtship behaviors. Sexual selection theory may explain social interactions of the sexes, where males display and attract mates more than females. These behaviors may intensify in a sexual environment. It was hypothesized that individuals would display more in a sexualized environment compared to a non-sexualized location. This research sampled $N = 880$ participants at a university in a southern state in North America and asked which unisex sunglasses they preferred. While the most popular non-showy sunglasses were selected the most, showy new arrival sunglasses were selected more often when the surveyor's behavior was flirty, compared to normal behavior and dressing sexy. Thus, social interactions such as flirting between the sexes impacted the behaviors of others and increased the intensity of reproductive displays. At the location with sexualized behaviors and dress, individuals selected the non-showy sunglasses, possibly to draw attention to their bodies in swimsuits, whereas at the non-sexy location, new arrivals were chosen at a higher frequency, possibly to stand out when wearing normal clothes. The sexes chose to stand out at equal frequencies as did single participants and people in a relationship, suggesting that all individuals are trying to display and attract mates equally. Social environments impacted display behaviors and the motivation to display is discussed.

Keywords: Sociology, Psychology

1. Introduction

1.1. Sexual conflict background

Males and females have different reproductive costs, where females usually invest more energy into each offspring and have a limited reproductive output compared to males, leading to distinct differences between male and female behaviors across the animal kingdom (Trivers, 1972). Females are usually removed from the reproductive pool during pregnancy, resulting in costly competition between males for a limited number of females (Emlen and Oring, 1977). Males most successful in attracting and obtaining mates, through competition, are ultimately most represented in the following generations. Darwin's (1871) theory of sexual selection explains how competition in one sex for reproductive access to the other sex, creates both behavioral and morphological differences between the sexes. In humans, men can reproduce continually through most of their reproductive life compared to women and this likely creates conflict (Kvarnemo and Ahnesjö, 1996).

Thus, there are usually more males reproductively available than females, leading to males competing for access to a limited number of females (Cronin, 1991). This bias in male competition versus female choosiness has resulted in morphological and behavioral differences, such as human male facial hair, musculature, and aggressiveness (Ellis, 1916). Thus, sexual selection theory can likely predict social interactions between the sexes. Generally, males have to find available females and behave uniquely to separate themselves from other males when competing for females, usually through displays such as antler size (Malo et al., 2005).

1.2. Displaying behaviors in different social interactions

Males demonstrate riskier behaviors in displaying to females and communicate they are better than their competition (Andersson, 1994). Men are no different and according to government statistics, men have a greater risk of physical harm in their reproductive years than women because of these riskier behaviors (Center for Disease Control, 2004). Male risk-taking behaviors increase in the presence of women (Pawlowski et al., 2008) and have likely evolved through competition for women, either directly or indirectly. Risk taking displays by men have been shown to extend beyond physical risks and into economic decisions (Powell and Ansic, 1997). From an evolutionary perspective, these risk taking behaviors must be beneficial as a form of display and attract potential mates.

Women often select men based on traits other than physical appearance and often rely more on the male status (Buss, 1989; Buss et al., 1990). Men in social

interactions separate themselves from their competition by displaying in the form of extravagant possessions, such as expensive cars, or by paying more for something in front of their peers or potential mates (Lycett and Dunbar, 1999; Griskevicius et al., 2007). This goes along with the conspicuous consumption theory, which states that people are often motivated to purchase goods and services for the benefit of public prestige or social status, rather than for the intrinsic value of the goods (Veblen and Banta, 2009). For men, conspicuous consumption increases with an increase in the number of men in a group (Lycett and Dunbar, 1999). Men have been shown to increase their spending, even to the point of debt, in a population with more men (Griskevicius et al., 2012). Therefore, men are driven by competition for a limited number of mates and try to “stand out” in social interactions by displaying. Displaying may encompass enhancing one’s physical appearance, social appearance or simply attracting more attention from others.

Male competition could be relaxed if females would not be limited, and instead females may engage in competition with each other for access to males. In an environment where females outnumber males, several species of females exhibit role-reversal by engaging in female-female competition for limited males (Gwynne, 1991). While increased female competition for males have been documented in other species (bush crickets: Kvarnemo and Simmons, 1999; seahorses: Kvarnemo et al., 2007), few studies have reported this in humans. Durante et al. (2012) found women were more likely to choose high paying careers in social interactions where there are more men in the environment. Female role-reversal by having more resources may enable them to stand out from other women. Female behavior, like male behavior, may vary based on population dynamics with an increased frequency of social interactions with members of the opposite sex.

Population dynamics such as local environmental cues can be related to the frequency, distribution, and behaviors of the choosier sex, which is usually female. As a result, the choosier sex’ behaviors often impact the social behaviors of the competitive sex. In animals, for example, female choice in birds often impacts male displays and song behaviors (Clark, 2009; Karubian et al., 2011). In primates, males are more likely to mate with females that exhibit cues of estrus (Beach, 1976). Thus, choosier sex social behaviors impact social interactions and reproductive decisions of the competitive sex, usually in the form of mating behaviors and visual displays. In humans, this scenario where behaviors of one sex impacts the behaviors of another sex has been documented scarcely in the literature, mostly regarding tipping behavior and waitress appearance or behavior (Guéguen and Jacob, 2014; Jacob and Guéguen, 2014; Johnston, 2010; Lynn and Mynier, 1993). Thus, combining 1) frequency of social interactions, 2) displaying behaviors of potential mates, and 3) responses to those displays can make sexual selection predictions and conflict hard to interpret.

1.3. Problem, objective, hypotheses

This study investigates how participants' choice is motivated and affected by social interactions in the environment and by surveyor behavior when sexual opportunities are present, often called mating cues. This study is unique because data were collected on choice preference associated with sexual selection of both men and women along with testing how potential mate behaviors impact others. Using sexual selection theory to predict social interactions, the objective was to determine what extent men will try to "stand out" from the crowd and be "showy" by selecting a flashier, less popular, and less conventional pair of sunglasses. Sunglasses are a very visible accessory and allow individuals to stand out. This study also evaluated whether women would demonstrate competition for men by selecting the "showy" sunglasses. In addition, the surveyors varied their social interactions by altering their dress or behavior at each location to see if the way the survey was delivered would affect the choices of the participants. Our hypotheses were 1) men would choose the "showy" sunglasses more than women, 2) single individuals would choose the "showy" sunglasses more than those in a relationship because they do not have a mate and would need to display and attract a mate, 3) individuals would choose the "showy" sunglasses at the sexualized location more than the non-sexualized location, 4) individuals would choose "showy" sunglasses more when the surveyors were dressed sexy.

2. Methods

2.1. Pre-test and focus groups

A pre-test with 3 focus groups (N = 45, average age = 18, males = 12, females = 33) was conducted with a group of non-participating college students at a university in a southern state in North America. Frequency data were collected. This pre-test group reported that sunglasses were an accessory and a possession that signaled having resources. Both sunglass choices, after trying them on, were determined to be unisex sunglasses that were acceptable and appropriate for both men and women students. Sunglasses were used without any brand name to lower the impact of conspicuous consumption (Veblen and Banta, 2009). Pre-test students were also questioned about what clothes are considered sexy dress on campus as well as what would be considered to be flirting behavior in person. Surveyor dress and behaviors were controlled to match these preliminary data from the focus group of students. Surveyors were trained on behaviors and the same surveyors participated in data collection at both locations. Flirting behaviors included smiling, laughing, and touching participants on the upper arm. Analyses from pre-test were used to determine surveyor dress and behavior as well as sunglass choices.

2.2. Methodology

The methodology and design of this experiment (adapted from [Griskevicius et al., 2006](#) and [Griskevicius et al., 2009](#); [Griskevicius et al., 2011](#)) was a choice preference between two styles of sunglasses (non-showy vs. showy) at two locations (a sexualized location vs. non-sexualized location). Each location had a table with two signs corresponding with two styles of sunglasses. The non-showy style sign stated they were the most popular and were unisex aviator-style sunglasses with black rims and black lenses. The showy style sign stated they were new arrivals and were unisex sunglasses with gold rims and black lenses. Mirrors were available for participants to use and try on the sunglasses. One location was a swimming pool and was considered to be our sexualized location ([Fig. 1a](#)), because men and women exposed much of their bodies. Men were usually shirtless and women usually wore small bikinis. The second “non-sexualized location” was a common walkway that was surrounded by a street and four academic buildings. This walkway is used by individuals walking to classes, offices, cafeterias, and dorms ([Fig. 1b](#)) and was distant from the sexy location; students were fully clothed in shorts/pants and shirts. Each location was surveyed at the busiest time periods and there were people not being surveyed around these locations. Otherwise, there were people around that individuals could display towards and attract. Surveys were collected in 1-hour intervals and a minimum of 100 surveys, were collected in each interval.



Fig. 1. (a) Sexy location, the pool. Participants were sunbathing and studying in beach lounge chairs in groups of men and women. A fence surrounded the location and other buildings were not easily visible. (b) Non-sexy location, the courtyard walkway. Four different buildings converge on our research area. Students were walking to and from classes, their dorm rooms, and the cafeteria. This study area was opposite on campus from the other research area, the pool.

2.3. Participants and surveyors

This study represents a 2 (sex) by 2 (locations) by 3 (behaviors) design. Men ($N = 339$) and women ($N = 531$), from a university in a southern state in North America, were voluntarily surveyed using a paper questionnaire ($N = 880$, mean age = $20.4 \pm SD 4.4$, range 18–70, sex-ratio 1:1.6; see raw data in supplemental material “Coded Raw Data for Wortham and Miller- displays in college students”). This research was approved by the Institutional Review Board at the University of Tampa (approval 16–008) and complies with laws in the United States of America and with the 1964 Declaration of Helsinki and its later amendments. All participants gave their informed consent to participate in the research study. Participants were asked their age, gender, if they were in a committed relationship, and which choice of sunglasses they preferred. Participants could only take the survey one time.

At least two surveyors (minimum 1 male & 1 female) were positioned at two different locations on campus where they recruited individuals to take the survey. Surveyors were randomly assigned to location and rotated between sites multiple times. Surveyors represented multiple ethnicities, were in good physical shape, and determined to be representative of the study population by a focus group ($N = 12$, average age = 20, from the same university). The surveyors altered their behaviors in three different trials at each location: 1) normal; normal dress in pants and a short-sleeve shirt, behaving normally (36% of surveys), 2) flirt; normal dress in pants and a short-sleeve shirt, behaving flirtatiously with the individuals taking the survey (32%), and 3) sexy; with men in dress pants and dressier/polo-styled shirts and girls in short dresses was used for the non-sexy location, while at the sexy location surveyors wore swimsuit attire, behaving normally (32%). Sexy dress varied between the two locations for the sexy trial after an informal survey revealed that swimsuit attire in the non-sexy location or cocktail attire in the sexy location would not have felt natural and may have caused people to be suspicious. Therefore surveyors dressed sexy for the given environment and in each trial only one variable was changed.

2.4. Data analyses

Regarding data analyses, some individuals did not complete a portion of the survey such as their gender or relationship status, and these surveys were excluded in the analyses that required that information. The surveys were coded, entered into SPSS, and checked 100% for data accuracy in data entry, and then cleaned to address missing values, outliers, or extreme values (Osborne, 2013). Choice data were categorical and data were analysed to see if normality assumptions were met. Behavioral data did not meet normality assumptions; hence chi-squared statistical tests and contingency tables were conducted.

3. Results

3.1. Population

There were fewer men (39%) surveyed than women (61%), 339 and 531 respectively ($N = 870$; $X^2 = 4.84$; $df = 1$; $p = 0.028$; effect size $\Phi = 0.08$). The sex-ratio of our study population (1:1.6) and mean age of participants (20.4) matched the overall population demographics of the university ($N = 8037$) ($X^2 = 0.42$; $df = 1$; $p = .52$; effect size $\Phi = 0.02$). Hence, the survey population was a true measure of the total population with regards to gender and age.

The percentage of surveys collected during each of the three surveyor trials was statistically equal ($N = 880$; $X^2 = 0.28$; $df = 2$; $p = 0.87$; effect size $\Phi = 0.02$). Fewer individuals were surveyed at the sexy location (41%) compared to the non-sexy location (59%), however, the number of surveys collected at each location was statistically equal ($N = 880$; $X^2 = 3.24$; $df = 1$; $p = 0.07$; effect size $\Phi = 0.08$). Most participants (67%) were single and not in a committed relationship ($N = 862$; $X^2 = 10.9$; $df = 4$; $p = 0.001$; effect size $\Phi = 0.11$).

3.2. Sunglass choice

More people chose the “most popular” and non-showy sunglasses compared to the “new arrivals” (showy), 90% compared to 10%, respectively (Fig. 2a; $N = 879$; $X^2 = 64.0$; $df = 1$; $p = 0.001$; effect size $\Phi = 0.27$). Most individuals selected the sunglasses that went along with the social trends and displayed “averagely” rather than display “showy” by selecting the new arrival sunglasses. Men and women chose the showy and most popular sunglasses equally (Fig. 2b; $N = 869$; $X^2 = 1.38$; $df = 1$; $p = 0.24$; effect size $\Phi = 0.27$), thus sex did not influence choice of sunglasses. Relationship status did not influence sunglass choice, as showy and non-showy sunglasses were chosen statistically equal between individuals in a relationship and those not in one (Fig. 2c; $N = 862$; $X^2 = 0.58$; $df = 1$; $p = 0.44$; effect size $\Phi = 0.03$). Against predictions, single individuals did not display more.

3.3. Location and surveyor behavior

Given the most popular sunglasses were selected more at both locations, selection of the new arrival sunglasses was analyzed between locations and surveyor conditions. When data from all surveyor conditions were pooled together, there was no significant difference in the percentage of individuals choosing the showy sunglasses between the non-sexy location and the sexy location (Fig. 3; $N = 879$; $X^2 = 0.96$; $df = 1$; $p = 0.33$; effect size $\Phi = 0.03$). Separating the data by surveyor behavior, choice of showy sunglasses at the non-sexy location was not affected by the behavior of the surveyors (Fig. 4; $N = 61$; $X^2 = 0.23$; $df = 1$; $p = 0.89$; effect size $\Phi = 0.004$). However, students at the sexy location chose the showy

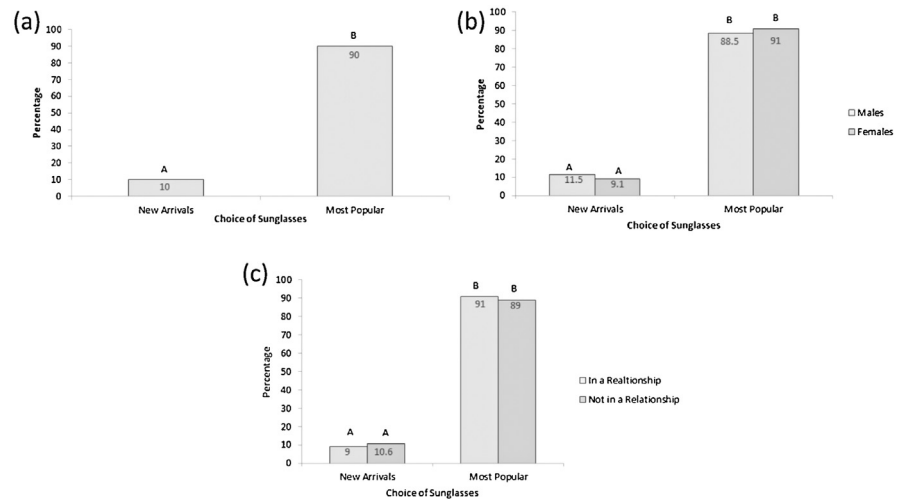


Fig. 2. (a) Sunglass choice of participants; sexes, study location, and surveyor behavior pooled. Most popular sunglasses were chosen more often. Note: different letters represent a statistical difference at the $p < 0.05$ level ($N = 879$, $X^2 = 64.0$, $df = 1$, $p = 0.001$). (b) Male and female choice of sunglasses. Men and women selected sunglasses equally ($N = 869$, $X^2 = 1.38$, $df = 1$, $p = 0.24$); men and women selected the showy/new arrival sunglasses the same suggesting that women were displaying at equal rates compared to men. (c) Relationship status and sunglass choice; single individuals chose showy sunglasses equally with those in a relationship ($N = 862$, $X^2 = 0.58$, $df = 1$, $p = 0.44$). This suggests that all individuals were likely still searching for a high quality mate regardless if already having a mate.

sunglasses more when the surveyors were behaving flirtatiously (Fig. 4; $N = 27$; $X^2 = 15.3$; $df = 1$; $p < 0.001$; effect size $\Phi = 0.75$). Showy sunglasses were chosen significantly more at the non-sexy location compared to the sexy location under the normal condition, 11% and 3% of the time, respectively (Fig. 4; $N = 22$; $X^2 = 4.571$; $df = 1$; $p < 0.033$; effect size $\Phi = 0.46$) and the sexy condition, 13% and 4% of the time, respectively (Fig. 4; $N = 28$; $X^2 = 4.765$; $df = 1$; $p < 0.029$; effect size $\Phi = 0.41$). The only time the showy sunglasses were chosen more at the sexy location than the non-sexy location was under the flirt condition (17% and 11%, respectively), although this difference was not significant (Fig. 4; $N = 38$; $X^2 =$

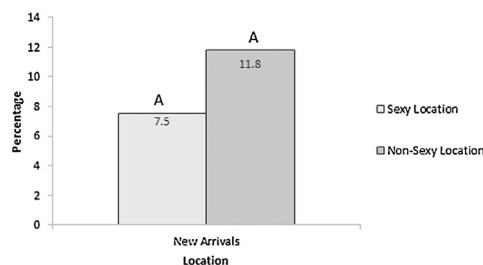


Fig. 3. Location and choice of new arrival sunglasses. ($N = 88$, $X^2 = 0.96$, $df = 1$, $p = 0.33$). Individuals selected the showy/new arrival sunglasses equally at both locations; however, they may be a trend to select these showy sunglasses more often at the non-sexy location.

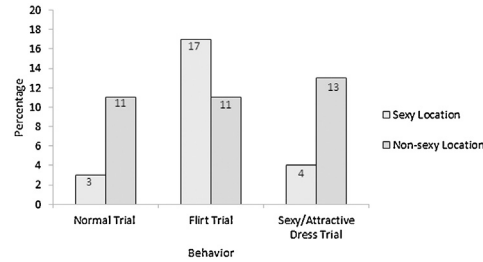


Fig. 4. Behavior impacts new arrival (showy) sunglass choice at different locations ($N = 22-61$, $X^2 = 0.23-15.3$, $df = 2$, $p < 0.001-0.89$). While the new arrivals were selected equally regardless of surveyor behavior (normal, flirt, sexy) at the non-sexy location, flirting did induce more participants to select the showy sunglasses at the sexy location, compared to normal and sexy surveyor behaviors.

1.29; $df = 1$; $p = 0.26$; effect size $\Phi = 0.18$). Overall, participants chose the new arrivals most frequently when surveyors were exhibiting flirtatious behavior (13.5%), followed by sexy dress and normal behavior (10%), and finally normal dress and normal behaviors (7%) (Fig. 5; $N = 879$; $X^2 = 1.8$; $df = 1$; $p < 0.41$; effect size $\Phi = 0.04$), but this was not statistically significant.

4. Discussion

4.1. General

Under sexual selection theory, men were expected to choose the showy sunglasses more frequently than women. This did not happen; the first hypothesis that men would choose the “showy” sunglasses as a form of display was rejected. This might suggest that: 1) male intrasexual selection (competition) decreased due to more females being present, and/or 2) female intrasexual selection (competition) was increased due to fewer men. Men may not display as much because of a lack of competition, whereas women may have to compete more due to increased competition for men; both could result in less differences between male and female choice behavior in sunglasses and thus the rate of displays between the sexes is similar.

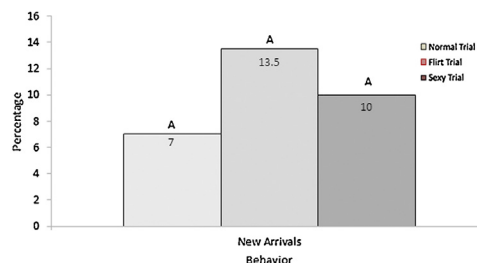


Fig. 5. New arrival (showy) sunglass choice during three behavioral trials ($N = 879$, $X^2 = 1.8$, $df = 2$, $p = 0.41$). While statistically equal, flirting behaviors tended to induce selection of the showy sunglasses more frequently compared to normal and sexy surveyor behaviors.

The second hypothesis predicted that single individuals would choose the “showy” sunglasses more and attract the attention of potential mates. However, single individuals did not choose the “showy” sunglasses more than those in a relationship. Many participants identified as not being in a committed relationship and were single; the population was relatively young and their definition of “relationship” may be very fluid. These factors may have obscured any true differences that existed between single and attached individuals. Further the individuals reported as being in a committed relationship, may still be open to a higher quality mate due to the large amount of time remaining in their reproductive life. This behavior may differ if older adults were surveyed, a project for future research.

Overall, the most popular sunglasses were chosen more often, regardless of surveyor behavior or location. Most individuals chose not to stand out. Lee et al. (2016) reported that being average may be better in terms of mate attraction; selecting the average, selecting like other people, and selecting the most popular and not standing out is a sign of good genes and of good health. Showiness or looking different such as wearing the gold sunglasses may be considered too extreme and trigger the primal response to avoid diseased or mutated individuals. Thus, a reason why most selected the most popular sunglasses may have been to fall within the social norm and bell curve of behaviors and appearances.

4.2. Possible role reversal

Most sexual selection predictions are based on a male-biased sex ratio (Darwin, 1871; Emlen and Oring, 1977; Cronin, 1991; Andersson, 1994). A shift in the sex ratio leads to a shift in social interactions and competition intensity (Kvarnemo and Ahnesjö, 1996). Only recently has it been shown that changes to this male-biased sex ratio can cause changes in human behavior (Durante et al., 2012; Moss and Maner, 2016). Further research has shown that females also demonstrate a shift in typical behaviors due to a shift in the sex ratio (Durante et al., 2012). This suggests a level of behavioral plasticity in both sexes that is dependent upon the sex ratio in the population.

In the study population, women are likely the sex, engaging in more intrasexual competition for access to men, whereas men are the choosier sex in the intersexual competition for a mating partner. In this study, women behaved equally as men in terms of displaying showiness. It is unlikely that male displaying behavior would cease. For example, males may still display to females; females prefer dominant males in female intrasexual competition for males (Smuts, 1985). Therefore, wearing showy sunglasses may be a way to distinguish dominance and gain female attention. Future research may focus on displaying behaviors in a population with an equal number and/or more men compared to women.

4.3. Impact of location and behavior

Individuals wearing non-showy clothes at the non-sexy location chose to be showy by standing out with their sunglasses choice. Whereas students already displaying at the sexy location did not chose to bring attention to their face by selecting showy sunglasses. Being in a sexy environment alone did not lead to showy displays. Thus, the hypothesis that individuals would choose the “showy” sunglasses more at the sexy location was rejected. Women are likely mimicking each other (Coleman et al., 2007) at the sexy location by showing more secondary sexual characteristics that are directly related to their reproductive ability (i.e. breast development, fat storage, and 0.7 waist to hip ratio). Thus, wearing showy sunglasses may draw attention away from these reproductive areas; hence the decrease of women selecting the gold/showy sunglasses at the sexy pool location. At the non-sexy location, wearing showy sunglasses would attract others; the individuals in this location were fully clothed, not openly displaying secondary sexual characteristics.

Social interactions with flirtatious surveyors resulted in the “showy” sunglasses to be chosen significantly more at the pool location, yet the same response was not noted at the non-sexy location. Thus, flirting alone is not likely to be a prime for mating. While dressing sexy can signal reproductive readiness and interest, flirting behavior directly engages the intersexual relationship and signals reproductive readiness clearer than dress. For example, in blue crabs, color of claws can signal when the female is reproductively active (similar to dress), however, the actual process of molting (behavior) signals the exact time that the female crab is reproductively ready (Baldwin and Johnsen, 2012). It is likely that we did not see a similar response at the non-sexy location because individuals were not primed to think about mating and simply did not respond to the flirtatious behavior alone. At the pool, the individuals were likely primed for mating behavior and did not want the sunglasses to distract from their exposed bodies, unless there appeared to be a personal interest from a surveyor and then natural desire to display by choosing the “showy” sunglasses resulted. Thus, there may be a possible interaction of sexualized location along with flirting that primes an individual for mating.

The main findings of this study are location and surveyor behavior can impact participants’ choice and behavior. While being in a sexualized environment likely primes the brain for sexual actions (Griskevicius et al., 2011), flirting in a sexy location is possibly the best interaction between habitat and behavior to induce displaying and mating behavior. Flirting in a non-sexualized environment did not induce showiness and displays. Thus, flirting alone is not a behavior that can change social behaviors, specifically another individual’s behavior; however adding a suitable location with flirtatious behavior can lead to changes in others’ behaviors. If salespeople in sexualized environments, such as in lingerie and beach stores, attempted to flirt with their customers, this behavior could lead to customers

purchasing showier items. However, salespeople in a non-sexy location may not see the same outcome of purchasing flashier clothes if they flirt with their customers. In schools, enabling a strict dress code that also restricts accessories and limiting flirting behaviors of students should decrease socially inappropriate behaviors.

These research findings are interesting, but the study has limitations and much can be expanded in future research. Gathering more information about participants would be beneficial, such as data on sexual and socialsexual orientations, demographics, and socioeconomic status, along with how long participants have been in a relationship. Collecting data on the total number of individuals at a testing location in the future would clarify if participants were around other individuals whom they could attract by displaying. Also, testing the relationship of choice based on the presence or absence of a brand name would have allowed for testing of the conspicuous consumption theory.

Declarations

Author contribution statement

Jen Wortham, Abraham Miller: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

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reviewers read a previous draft of this manuscript and made suggestions that improved the manuscript.

References

- Andersson, M., 1994. *Sexual Selection*. Princeton University Press, Princeton, NJ.
- Baldwin, J., Johnsen, S., 2012. The male blue crab, *Callinectes sapidus*, uses both chromatic and achromatic cues during mate choice. *J. Exp. Biol.* 215 (7), 1184–1191.
- Beach, F.A., 1976. Sexual attractivity, proceptivity, and receptivity in female mammals. *Horm. Behav.* 7 (1), 105–138.
- Buss, D.M., 1989. Sex differences in human mate preference: evolutionary hypothesis tested in 37 cultures. *Behav. Brain Sci.* 12, 1–49.
- Buss, D.M., Abbott, M., Argleitner, M., et al., 1990. International preferences in selecting mates: a study of 37 cultures. *J. Cross-Cult. Psychol.* 21 (1), 5–47.
- Center for Disease Control, 2004. United States Center for Disease Control (n.d.). National Data on Deaths by Cause . <http://www.cdc.gov/>.
- Clark, C.J., 2009. Courtship dives of Anna's hummingbird offer insights into flight performance limits. *Proc. R. Soc. Lond B Biol. Sci.* 276, 3047–3052.
- Coleman, S.W., Patricelli, G.L., Coyle, B., Siana, J., Borgia, G., 2007. Female preferences drive the evolution of mimetic accuracy in male sexual displays. *Biol. Lett.* 3 (5), 463–466.
- Cronin, H., 1991. *The Ant and the Peacock*. Chicago Press, Chicago, IL.
- Darwin, C.R., 1871. *The descent of man, and selection in relation to sex*. John Murray, London, England.
- Durante, K.M., Griskevicius, V., Simpson, J.A., Cantu, S.M., Tybur, J.M., 2012. Sex ratio and women's career choice: does a scarcity of men lead women to choose briefcase over baby? *J. Pers. Soc. Psychol.* 103 (1), 121–134.
- Ellis, H., 1916. *Man and Woman: A study of human secondary sexual characteristics*. Walter Scott Publishing Company, London, England.
- Emlen, S.T., Oring, L.W., 1977. Ecology, sexual selection, and the evolution of mating systems. *Science* 197 (4300), 215–223.
- Griskevicius, V., Goldstein, N.J., Mortensen, C.R., Cialdini, R.B., Kenrick, D.T., 2006. Going along versus going alone: when fundamental motives facilitate strategic (non)conformity. *J. Pers. Soc. Psychol.* 91 (2), 281–294.

Griskevicius, V., Tybur, J.M., Sundie, J.M., Cialdini, R.B., Miller, G.F., Kenrick, D.T., 2007. Blatant benevolence and conspicuous consumption: when romantic motives elicit strategic costly signals. *J. Pers. Soc. Psychol.* 93 (1), 85–102.

Griskevicius, V., Goldstein, N.J., Mortensen, C.R., Sundie, J.M., Cialdini, R.B., Kenrick, D.T., 2009. Fear and loving in Las Vegas: evolution, emotion, and persuasion. *J. Mark. Res.* 46, 385–395.

Griskevicius, V., in Levy, E., Sharp, G., Younger, J., 2011. *The Science of Lust-Discovery Channel. The Incubator, USA.*

Griskevicius, V., Tybur, J.M., Ackerman, J.A., Delton, A.W., Robertson, T.E., White, A.E., 2012. The financial consequences of too many men: sex ratio effects on saving, borrowing, and spending. *J. Pers. Soc. Psychol.* 102 (1), 69–80.

Guéguen, N., Jacob, C., 2014. Clothing color and tipping: gentlemen patrons give more tips to waitresses with red clothes. *J. Hosp. Tour. Res.* 38 (2), 275–280.

Gwynne, D.T., 1991. Sexual competition among females: what causes courtship-role reversal? *Trends Ecol. Evolut.* 6 (4), 118–121.

Jacob, C., Guéguen, N., 2014. The effect of employees' clothing appearance on tipping. *Journal of Foodservice Business Research* 17 (5), 483–486.

Johnston, D.W., 2010. Physical appearance and wages: do blondes have more fun? *Econ. Lett.* 108, 10–12.

Karubian, J., Lindsay, W.R., Schwabl, H., Webster, M.S., 2011. Bill coloration, a flexible signal in a tropical passerine bird, is regulated by social environment and androgens. *Anim. Behav.* 81 (4), 795–800.

Kvarnemo, C., Ahnesjö, I., 1996. The dynamics of operational sex ratios and competition for mates. *Trends Ecol. Evolut.* 11 (10), 404–408.

Kvarnemo, C., Simmons, L.W., 1999. Variance in female quality, operational sex ratio and male mate choice in a bushcricket. *Behav. Ecol. Sociobiol.* 45 (3-4), 245–252.

Kvarnemo, C., Moore, G.I., Jones, A., 2007. Sexually selected females in the monogamous Western Australian seahorse. *Proc. R. Soc. Lond. B. Biol. Sci.* 274 (1609), 521–525.

Lee, A.J., Mitchem, D.G., Wright, M.J., Martin, N.G., Keller, M.C., Zietsch, B.P., 2016. Facial averageness and genetic quality: testing heritability, genetic correlation with attractiveness, and the paternal age effect. *Evol. Hum. Behav.* 37 (1), 61–66.

- Lycett, J.E., Dunbar, R.I.M., 1999. Mobile phones as lekking devices among human males. *Hum. Nat.* 11 (1), 93–104.
- Lynn, M., Mynier, K., 1993. Effect of server posture on restaurant tipping. *J. Appl. Soc. Psychol.* 23 (8), 678–685.
- Malo, A.F., Roldan, E.R., Garde, J., Soler, A.J., Gomendio, M., 2005. Antlers honestly advertise sperm production and quality. *Proc. R. Soc. Lond. B. Biol. Sci.* 272 (1559), 149–157.
- Moss, J.H., Maner, J.K., 2016. Biased sex ratios influence fundamental aspects of human mating. *Pers. Soc. Psychol. Bull.* 42 (1), 72–80.
- Osborne, J.W., 2013. *Best practices in data cleaning: a complete guide to everything you need to do before and after collecting your data.* Sage publishing, Los Angeles.
- Pawlowski, M., Atwal, R., Dunbar, R.I.M., 2008. Sex differences in everyday risk taking behavior in humans. *Evol. Psychol.* 6, 29–42.
- Powell, M., Ansic, D., 1997. Gender differences in risk behavior in financial decision-making: An experimental analysis. *J. Econ. Psychol.* 18, 605–628.
- Smuts, B.B., 1985. *Sex and friendship in baboons.* Transaction Publishers, Livingston, NJ.
- Trivers, R.L., 1972. Parental investment and sexual selection. In: Campbell, B. (Ed.), *Sexual Selection and the Descent of Man.* Aldine, Chicago, pp. 136–179.
- Veblen, T., Banta, M., 2009. *The theory of the leisure class.* Oxford University Press, Oxford, England.