SOCIAL COMPARISON TENDENCIES AND THE REWARD VALUE OF SAME-SEX BEAUTY AMONG HETEROSEXUAL WOMEN

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Abstract

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Previous studies have suggested that heterosexual women, but not heterosexual men, find same sex beauty rewarding. This finding has been attributed to a "greater bisexual interest among heterosexual women", but no other explanations have been offered or tested. The current study aimed to explore social comparison tendencies as a potential alternate explanation to this previously observed finding. Twenty-three heterosexual women completed a series of questionnaires designed to assess their social comparison tendencies (the social comparison orientation scale, the physical appearance comparison scale, and the intrasexual competition scale). They also completed a "pay-per-view" keypress task to measure the reward value of attractive female faces. The previous finding, that same-sex beauty holds reward value for heterosexual females, was replicated in the current work. However, none of the social comparison tendencies measured were found to predict the reward value of same-sex beauty. These results do not support the hypothesis that social comparison tendencies may, at least in part, explain the reward value of same-sex beauty among heterosexual women. However, due to the small sample size these results should be interpreted somewhat cautiously.

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One day, in retrospect, the years of struggle will strike you as the most beautiful.

- Sigmund Freud

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Introduction

Previous research using a "pay-per-view" keypress task (Aharon et al., 2001; Hahn et al., 2013; Levy et al., 2008) has demonstrated that same-sex beauty has reward value to heterosexual women. Although it has been suggested that this finding reflects some form of sexual attraction (Levy et al., 2008), no alternative hypotheses have been put forward or tested. Here, I suggest that women may be exerting effort to prolong the viewing of attractive peers to "check out the competition"; women may find same-sex beauty rewarding because they are motivated to view attractive same-sex rivals as a form of social comparison that could facilitate intrasexual competition by providing women with information for self-improvement. Gathering relevant information about competitors may help aid women to determine when it is worthwhile to invest effort in potential mating opportunities; when there is high competition (i.e., attractive rivals), women may waste energy pursuing potential mates who might choose another female. Thus, social comparison, rather than or in addition to women's fluid sexual preference, could underlie motivation to view same-sex beauty.

What is Attractiveness?

Beauty, or attractiveness[1], is difficult to quantify – we may "know it when we see it", but it is hard to measure objectively. Decades of research have sought to identify the factors that influence our perception of attractiveness. In their comprehensive review of the literature, Little et al. (2011) outline several facial traits have been proposed to

[1] Although colloquially beauty and attractiveness are used interchangeably, most of the scientific research on this topic uses the term attractiveness. For the purposes of this thesis, the terms beauty and attractiveness are considered synonymous.

influence the perception of facial attractiveness specifically. In particular, they outline the four most widely studied and accepted traits that are related to facial attractiveness: symmetry (i.e., the extent to which the left and right halves of the face are the same), averageness (i.e., how closely a face resembles a majority of other faces within a population), sexual dimorphism (i.e., sex-typical characteristics, often referred to as masculinity/femininity), and health (i.e., traits purported to be associated with good genes or current condition).

Facial symmetry is thought to be attractive because it may be indicative of a potential mate's ability to provide direct benefits (e.g., avoiding or successfully fighting off contagions during development) as well as indirect benefits (e.g., providing healthy genes for offspring). Studies using both natural variation in symmetry (e.g., Penton-Voak et al., 2001, Scheib et al., 1999) and experimentally manipulated facial symmetry (Penton-Voak et al., 2001, Thornhill et al., 1993, Roberts et al., 2005) have consistently shown that people do, indeed, find more symmetrical faces to be more attractive.

Facial averageness is purported to be linked to perceived attractiveness because it reflects increased genetic heterozygosity (Roberts et al., 2005). Although there is evidence that average faces are considered more attractive (Little et al., 2011), the link between facial averageness and perceived attractiveness has been called into question by work showing that the direction of deviation from average may play a role in either decreasing or increasing attractiveness (Debruine et al., 2007, Perrett et al., 1994).

Sexual dimorphisms in facial appearance reflect the development of secondary sexual characteristics in the face (e.g., "strong jaw", "high cheek bones", etc.) which are

typically referred to as being masculine or feminine. Sexual dimorphism of the face proposed to be attractive because they advertise those qualities of an individual in terms of heritable benefits, indicating that the owners of such characteristics possess good genetic factors. Extensive evidence has shown that feminine female faces are in fact considered attractive (e.g., Glassenberg et al., 2010, Penton-Voak et al., 2004, Perrett et al., 1998), while the link between male facial masculinity and perceived attractiveness is more tenuous (e.g., DeBruine et al., 2010, Ekrami et al., 2021, Perrett et al., 1998, Jones et al., 2001, Jones et al., 2004, Jones et al., 2005).

An element of facial appearance that has more recently received attention in with regard to its role in attractiveness is health. Indeed, both averageness and symmetry often presumed to be related to underlying health in some way and may signal mate quality in that they relay health-related information. The most well-studied aspects of facial appearance related to perceptions of health are skin color and skin texture. Studies have controlled for color and texture by regulating the faces showing that the homogeneity of skin color and texture has shown that more homogeneity in these traits is perceived as more attractive (Apicella et al. 2007, Fink et al., 2006, Jones et al., 2007, Rhodes et al., 1996). Although perceived health is difficult to pinpoint through any singular system of measurement, people will readily rate faces for perceived health and show high agreement ratings. The role of facial health helps individuals detect healthy potential partners (Little et al., 2011).

The Beauty Premium

Beauty is often considered the most elusive commodity (Fallon et al., 1990), and there is a well-documented "beauty premium" whereby what is attractive is considered good. Research shows that attractive individuals are often assumed to possess more positive personality traits than less attractive people (i.e., social stereotyping, Berscheid et al., 1971, 1974; Snyder et al., 1977; Zebrowitz et al., 2002; the "attractiveness halo", Feingold, 1992; Langlois et al., 2000). Facial attractiveness, in particular, influences important social judgments, such perceptions of competence or intelligence (e.g., Talamas et al., 2016; Zebrowitz et al, 2002) and perceptions of honesty and trustworthiness (e.g., Bascandziev et al., 2014; Dion et al., 1994). For example, research shows that facial attractiveness is positively correlated with perceived intelligence amongst multiple age groups, indicating that people assume attractive people are more intelligent (Talamas et al., 2016; Zebrowitz et al, 1990; Zebrowitz et al., 1997; Zebrowitz et al., 2002).

People regularly make a variety of social judgments based on the attractiveness of others, and these judgments can have important social outcomes. Attractiveness influences aspects of social success (e.g., Prestia et al., 2002; Riggio et al., 1984) as well as mating success (see Langlois et al., 2000 for a meta-analytic review). For example, individuals who are physically attractive are more popular and tend to have more friends than individuals who are less physically attractive (Anderson et al., 2001; Feingold et al., 1992). Attractive people also tend to have an advantage when it comes to the dating (Dion et al., 1972; Hamermesh et al., 1993); physically attractive people report to having

higher levels of dating experience than their less attractive counterparts (Berscheid et al., 1971; Walster et al., 1966). Using computerized dating settings, Walster et al. (1966) demonstrated that both men and women liked attractive potential dates better than unattractive ones (regardless of the participants' own level of attractiveness), and that they were more likely to seek additional dates with the more attractive individuals. While there is, of course, some degree of individual variation in what is considered attractive, meta-analytic work has demonstrated that there is a high degree of agreement both within and between cultures on the features people consider attractive in facial perception (Langlois et al., 2000).

Beauty is Rewarding

Across a number of studies, beautiful faces activate neural structures considered to be components of the brain's reward circuitry (Aharon et al., 2001; Ishai et al., 2007; Kampe et al., 2001; Kranz et al., 2006; O'Doherty et al., 2003). The brain's reward circuit or pathway is known as the mesocorticolimbic dopamine pathway (see Figure 1 for a visual representation of the brain's reward circuitry). This reward circuit links together a number of brain structures which regulate our ability to feel pleasure and desire; those feelings in turn may motivate us to repeat certain behaviors. This pathway originates primarily in the ventral tegmental area (VTA) located in the midbrain (Nestler et al., 2004). From there, the pathway projects up to the nucleus accumbens (NAcc) and other limbic structures (e.g., amygdala; Nestler et al., 2004; Baxter et al., 2002), as well as frontal regions (e.g., the prefrontal cortex; Koepp et al., 1998). When rewarding stimuli are presented, this neural circuit becomes activated. Neuroimaging work has

shown that attractive faces elicit stronger activation from these brain regions than unattractive faces suggests that beauty may be rewarding in the same fashion as money, drugs, and other "classic rewards" (Aharon et al., 2001; Ishai, 2007; Kampe et al., 2001; Kranz et al., 2006; O'Doherty et al., 2003).

Figure 1

Mesocorticolimbic pathway (green/blue routes) beginning in the VTA, projecting to the NAcc and frontal regions.

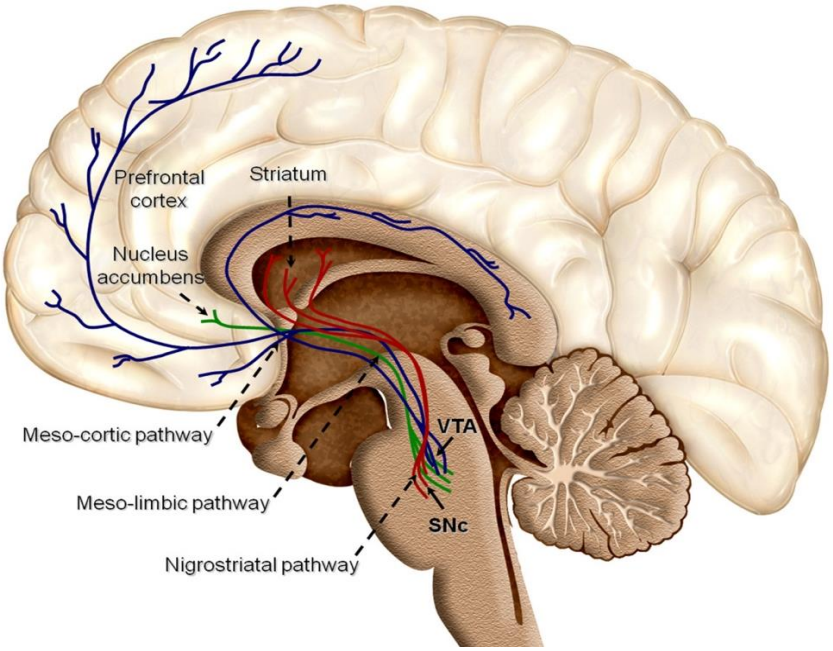


Image credit: https://en.wikipedia.org/wiki/Mesolimbic_pathway

The Incentive Salience Theory of Reward

The incentive salience hypothesis, parses reward into three distinct states: (1) learning – the process by which knowledge of the relationships among stimuli is gained,

(2) liking – the hedonic consequences of reward consumption, and (3) wanting – the motivation to learn and act in order to gain rewards (Berridge et al., 2003; Robinson et al., 1993; see Figure 2). Neuroscience research indicating that it is possible to alter liking responses without influencing wanting (and vice versa) has demonstrated that these states are dissociable aspects of reward that have distinct neural substrates (Berridge et al., 1998, 2003; Peciña et al., 2000; Peciña et al., 2003).

Figure 2

The psychological components of the incentive salience of wanting and the hedonic impact of liking, how the components are measured and the brains conscious and non-conscious circuitry involvement.

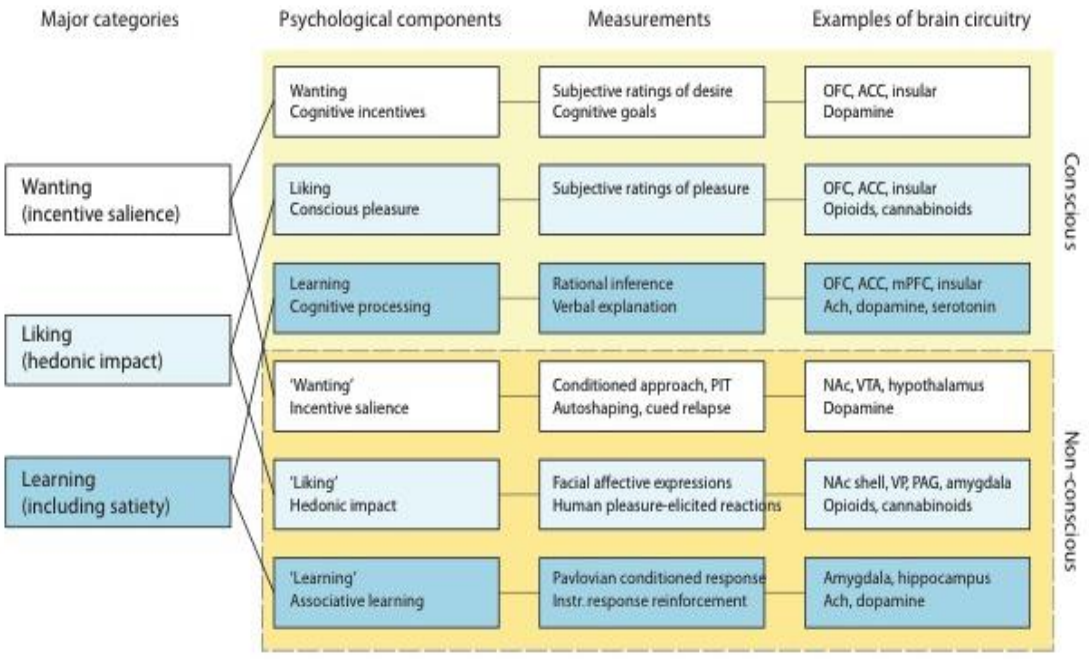


Image credit: https://psywb.springeropen.com/articles/10.1186/2211-1522-1-3

Liking

Liking reflects the hedonic value of a stimulus. For most people, a reward is something desired because it produces a conscious experience of pleasure — and thus the term may be used to refer to the psychological and neurobiological events that produce subjective pleasure (Berridge et al., 2009). Research using primarily rodent models has identified "hedonic hotspots" distributed throughout the brain; each hedonic hotspot has the ability, when neurochemically stimulated, to amplify liking reactions, and so make a stimulus seem even more enjoyable (Berridge et al., 2016). Liking can be measured both implicitly and explicitly, although the latter is restricted to humans. Implicit liking reactions to hedonic stimuli can be measured in behavior or physiology without conscious feelings of pleasure. Most studies have focused on implicit liking, given this can be assessed across species. Implicit liking is most commonly assessed through facial expressions in response to taste stimuli or food pleasures. More specifically the tongues response to liked stimuli and its response to disliked stimuli. In the case of humans, it is possible to assess explicit liking responses using Likert-style scales.

Wanting

Wanting serves as a different psychological component of reward, separate from liking. It serves more as an attribution to rewards which helps determine their motivational value or incentive salience (Berridge et al., 2009). Predictive cues that are tied to a rewarding outcome become a trigger of that wanted reward. This reflects how cravings can be triggered by a conditioned stimulus or reward cue which can then manifest as a cue trigger for wanting. It makes that stimuli more desirable and that reward

becomes enhanced by the motivation that is needed to fulfil that craving. Wanting is a process that can even be triggered in brain without conscious awareness (Berridge et al., 2009).

Measures of motivational effort can also be used across human and non-human animal studies of wanting. For example, the classic lever press paradigm used to assess motivation in many animal species (e.g. Wyvell et al., 2000) has recently been adapted in interesting ways to measure human behavior. A number of studies have assessed the reward value of social stimuli using a "pay-per-view" keypress task (e.g., Aharon et al., 2001; Hahn et al., 2013). The keypress task allows participants to control the viewing duration of an image by pressing designated keys on their keyboard. The length of time a given stimuli is displayed for could be increased by alternately pressing the 7 and 8 keys or decreased by alternately pressing the 1 and 2 keys. Each key press increases or decreases the viewing duration by 100 ms (Hahn et al., 2016a). This key-press method of gauging reward when activating the brain's mesocorticolimbic dopamine system is conceptually similar to the *'Skinner Box'* (see Figure 3), developed by B.F. Skinner to study the behavioral aspects of operant conditioning and positive reinforcement using non-human animals (Skinner, 1948). Using this key-press task, participants show motivation to increase their effort for the viewing length of the stimuli. Much like Skinner's work, pleasant consequences in this case, pressing designed keys showing motivation and working in an effort in receiving the reward of viewing attractive faces.

Figure 3

The Skinner Box. A rat is shown working for a reward by pressing a designed lever to dispense a food pellet. The keypress paradigm is conceptually similar to the Skinner Box in that participants can exert effort to interact with a stimulus.

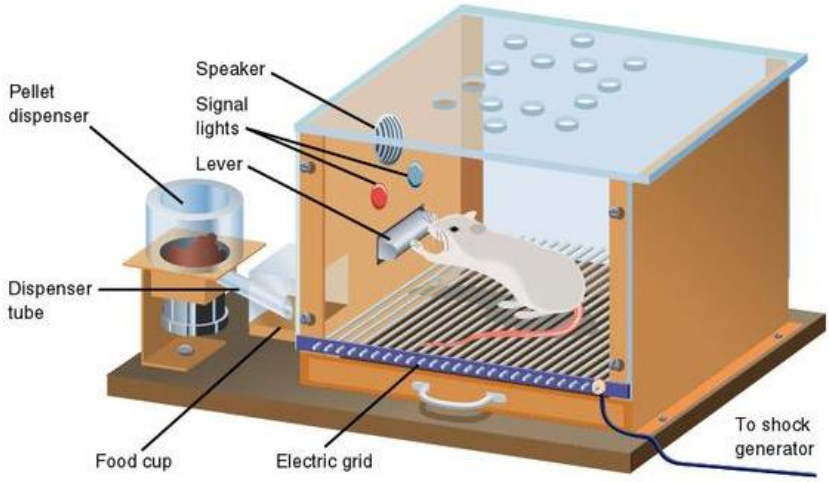


Image credit: https://www.simplypsychology.org/operant-conditioning.html

Faces as Rewards

Neuroimaging studies have demonstrated that facial attractiveness is rewarding, in that attractive faces elicit stronger activation from the brain's reward circuitry than do unattractive faces (Aharon et al., 2001; Ishai et al., 2007; Kampe et al., 2001; Kranz et al., 2006; O'Doherty et al., 2003). In line with the incentive salience theory of reward, facial attractiveness elicits affective responses as well as influences motivational behavior (i.e. our liking and wanting responses). Facial electromyography research suggests that unconscious liking responses are affected by facial attractiveness (Principe et al., 2011). Facial movements associated with disgust responses were found to be inversely correlated to the attractiveness of the face, suggesting that unattractiveness is disliked.

When it comes to conscious wanting behaviors that are subjected to the effects of attractiveness, people are much more likely to actively seek out dates with attractive individuals (Walster et al., 1966; Woll et al., 1986). Similarly, (Wilson et al., 2004) has demonstrated that unconscious wanting behaviors are also impacted by facial attractiveness; viewing beautiful women led men to discount higher future rewards against smaller, immediate rewards.

The "pay-per-view" keypress task (described above) has also been used to assess this unconscious wanting behavior for faces generally, as well as facial attractiveness (e.g., Aharon et al., 2001; Hahn et al., 2013). Behavior on the keypress task has been shown to overlap with neural activity in reward regions (Aharon et al., 2001). In an early study (Aharon et al., 2001), heterosexual males completed one of three tasks: group 1 passively viewed faces during an fMRI scanning, group 2 rated the attractiveness of the same faces, and group 3 performed the key-press task for the same set of faces. All participants saw faces in 4 categories: attractive male, unattractive male, attractive female, unattractive female. The neuroimaging data showed six brain regions that were differentially activated for facial beauty; the nucleus accumbens (NAcc), sublenticular extended amygdala (SLEA) of the basal forebrain, amygdala, hypothalamus, orbitofrontal cortex (OFC), and the ventral tegmental area (VTA) of the midbrain. These areas have all been associated with reward function in animals as well as humans (Berns et al., 2001; Breiter et al., 1997, 2001; Delgado et al., 2000; Elliott et al., 2000; Knutson et al., 2000, 2001; Rogers et al., 1999; Small et al., 2002; Stein et al., 1998; Thut et al., 1997). Importantly, Aharon et al., 2001's results demonstrated that behavior on this key-press

task overlapped with the observed patterns of neural activity better than did the rating data. For both the fMRI and keypress tasks, responses to facial attractiveness were higher for attractive females than attractive males. However, for the rating task, attractive males and females were rated equally highly. This finding suggests that although men can appreciate (or like) same-sex beauty, only opposite-sex beauty is rewarding. This finding also demonstrates that the key-press task is a valid behavioral measure of the reward value of stimuli.

Levy et al. (2008) used the same key-press paradigm to investigate the motivational salience of beauty using a sample of both heterosexual men and heterosexual women. As was observed previously Aharon et al. (2001), heterosexual men exerted greater effort (via a higher number of key-presses) to view the attractive female faces compared to unattractive female faces, however this difference was not apparent for the male faces (although they did rate the attractive males as significantly more attractive than the unattractive males). Heterosexual women showed this same pattern of behavior for the reward value of opposite-sex faces (i.e., key-pressed more for attractive males than unattractive males). Interestingly, however, the same heterosexual women also exerted effort to prolong the viewing of attractive *same-sex* faces. This finding suggests that while opposite-sex beauty holds greater reward value for heterosexual men, heterosexual women find both opposite-sex and same-sex beauty equally rewarding.

These motivational key press results of same-sex beauty and attractiveness are also consistent with Lippa et al.'s work (2010). In their study, heterosexual men and women passively viewed swimsuit models who varied in levels of attractiveness. They

were asked to rate the degree of their sexual attraction to the models using a 7 –point Likert scale ranging from 1 (not at all sexually attractive) to 7 (extremely sexually attractive). Heterosexual men reported more sexual attraction and spent more time looking at the highly attractive female models. However, heterosexual women were found to be sexually attracted to and look at both male and female models. For the heterosexual women, high photo model attractiveness was associated with both increased sexual attraction and increased viewing time for both male and female models.

Why do Women Find Same-sex Beauty Rewarding?

(Levy et al., 2008) argued that the observed reward value of same-sex beauty for women, but not men, may reflect a "greater bisexual interest among heterosexual women". Indeed, previous sex research has suggested that heterosexual women display reduced category specificity of arousal compared to heterosexual men and homosexual men and women (for a meta-analytic review, see Chivers et al., 2010). Category specificity can be defined as sexual arousal response patterns (i.e. physiological genital response) that reflect a person's sexual preferences (in terms of the object of desire as well as sexual acts; Chivers et al., 2004). (Chiver's et al., 2004) work has shown that men have high category-specificity in their sexual arousal (heterosexual men are more aroused more by female than by male sexual stimuli, whereas homosexual men show the opposite pattern) however women, and heterosexual women in particular, display less category-specificity (meaning they are aroused by stimuli they would not necessarily report an objective attraction to, including non-consensual sex acts and sexual films depicting non-human primates; reviewed in (Chivers et al., 2005).

Differences in sexual arousal responses between men and women have also been measured through pupil dilation. (Rieger et al., 2012) had heterosexual and homosexual men and women rate a 30 second video showing a naked male or female model masturbating. The participants then rated the videos based on how sexually appealing they found the model. Pupil responses were based on the changes of the pupil area when viewing the sexual stimuli in comparison to the neutral landscape stimuli. The results showed that heterosexual women showed similar levels of pupil dilation to both the male and female sexual stimuli.

The reward value of same sex beauty may be attributed, as (Levy et al., 2008) suggests, to women's fluid and flexible sexuality that is influenced by situational, relational, social and cultural factors (Baumeister et al., 2000; Diamond et al., 2000, 2008, 2016). Is this the only explanation for women finding same-sex beauty rewarding, however? While no other explanations have been empirically tested, another contributing factor could be that women may be working to prolong the viewing time of attractive same-sex faces as some form of social comparison that might facilitate intra-sexual competition. Female intra-sexual competition may manifest in terms of what is most preferred by the opposite sex – men show strong preferences for physical attractiveness; therefore, women are expected to compete with one another in terms of physical attractiveness (Buss, 1988a). Because physical attractiveness is more important to men than women when considering a potential mate (e.g., Buss, 1988a), social comparisons based on physical attractiveness could be more common among women (who are therefore subject to greater competition with respect to physical attractiveness). Physical

attractiveness is largely important to people's self-concepts and is a central dimension on which people compare themselves to others (Brase et al., 2004; Thornton et al., & Ryckman, 1991; Wheeler et al., 1992). Viewing attractive same sex individuals as a form of social comparison could potentially involve observing certain features and characteristics of attractive women, thereby gaining information about what is considered to be attractive with the goal of self-improvement and/or competitor monitoring.

Indeed, previous research has shown that women often compare their bodies with those of same-sex models they see in the media (e.g., Carlson Jones et al., 2004) and in advertisements (e.g., Posavac, Posavac & Weigel, 2001). Additionally, previous research using this key-press paradigm has provided some evidence that women may exert effort to view attractive female faces as a form of social comparison that could benefit intra-sexual competition. A study conducted by (Wang et al., 2014) using this key-press task looked at how women's hormonal levels modulate the reward value of faces. Their results demonstrated that women's testosterone levels, which have been positively linked to intra-sexual competition (Hahn et al., 2016b), predicted the reward value of female facial attractiveness – meaning that women worked harder to view attractive conspecifics when their testosterone levels were higher.

Together, these findings lend support to the idea that women may exert effort to view attractive female faces as a form of social comparison that could benefit intra-sexual competition. Gathering relevant information about competitors may help aid women to determine when it is worthwhile to invest effort in potential mating opportunities; when there is high competition (i.e., attractive rivals), women may waste energy pursuing

potential mates who might choose another female. Thus, social comparison, rather than or in addition to women's fluid sexual preference, could underlie motivation to view same-sex beauty. It is possible women may be exerting effort to prolong the viewing of attractive peers to "check out the competition". Therefore, the reward value of same-sex beauty could reflect subtle enhanced monitoring of attractive competitors to enhance the positive qualities of oneself (Fisher et al., 2009).

Social Comparison

Social comparison theory, first proposed by Festinger (1954) focuses on the belief that people are driven to evaluate their opinions and abilities and often look to similar as a form of comparative evaluation. The more important or self-relevant the opinions and abilities, the greater drive for social comparison (Festinger, 1954; Helgeson et al., 1995). Festinger (1954), as well as Wheeler (1966) expanded on this original concept – they hypothesized that there can be an upward drive of social comparison where the comparison is paralleled with slightly better-off others (highly attractive individuals). Here the underlying motive for social comparison in this case would be for the purpose of self-improvement. Many individuals want and believe they have positive characteristics; therefore, they perceive similarity with upward targets (Collins et al., 2000).

The Reward Value of Social Comparison

Further supporting the idea that the observed reward value of same-sex beauty among women may reflect some sort of social comparison behavior, neuroimaging work has indicated that the process of social comparison often involves brain regions that have also been implicated in reward processing (e.g., Dvash et al., 2010; Fliessbach et al.,

2007; Linder et al., 2014). For example, several studies have demonstrated increased activity in the ventral striatum when individuals engage in social comparison via monetary gains (Dvash et al., 2010, Fliessbach et al., 2007, Izuma et al., 2008) or status/reputation (Izuma et al., 2008, Linder et al., 2014, Zink et al., 2008). Bahnji (2014) argues that the "sensitivity of striatal activity to social comparison may serve a purpose to increase or maintain social status" (p. 8).

Beauty comparisons specifically (although not necessarily comparisons to the self) have also been shown to involve the same frontoparietal network known for involvement in nonsocial comparisons, including the intraparietal sulcus and dorsomedial prefrontal cortex (Kedia et al., 2013). Kedia and colleagues (2013) assessed neural activity during beauty judgments in a sample of young women using fMRI. Participants viewed images of women and dogs rated as high, middle, and low with regard to attractiveness. Their results demonstrated that beauty comparisons engaged the frontoparietal comparison system, which is consistent with research on other rewarding stimuli such as money (Wunderlich et al., 2009; Hare et al., 2011). This study provides contributing evidence that physical attractiveness comparisons engage in the same mechanism as comparisons of simple non-social magnitudes. These results also provide an indication for overlapping processes in the comparison of physical attractiveness as well as nonsocial magnitudes and therefore suggest that attractiveness comparisons rely on the same comparative process as nonsocial comparisons.

The Current Study

In light of the literature review, it is possible that the previously observed reward value of same-sex beauty among women reflects the potentially rewarding nature of social comparison rather than, or in addition to, sexual attraction. It may be that women find same-sex beauty rewarding because they are motivated to view attractive same-sex rivals as a form of social comparison that could facilitate intrasexual competition by providing women with information for self-improvement. If participants are working to prolong the viewing time of attractive same-sex faces as a form of social comparison, then we would assume that social comparison tendencies will impact the motivation to view same-sex beauty. The purpose of the present study is to investigate the impact of social comparison tendencies on the reward value of same-sex beauty among women to test this hypothesis.

Hypothesis 1

This study will replicate previous findings regarding the reward value of same-sex beauty. Specifically, I expect that heterosexual female participants will exert greater effort (measured as number of keypresses) to view attractive female faces compared to unattractive female faces.

Hypothesis 2

If the motivation to view same-sex beauty simply reflects a less stringent sexual preference or a greater bisexual interest as previously suggested (Levy et al., 2008), then all women will work to view the attractive same-sex faces regardless of the likelihood to engage in social comparison behaviors. If, however, the reward value of same-sex beauty

reflects some degree of social comparison, then who women who report a greater tendency to engage in social comparison behaviors would work harder to view attractive female faces. Therefore, I predict a positive relationship between all three measures (social comparison, physical appearance comparison, and intrasexual competition) and the reward value of female attractiveness.

Methods

Participants

Thirty-seven women, age 18-38 years (*M* = 23.8 years, SD = 5.4), completed the study online. This sample was composed of white (59%), Latina (21%), Asian (8%), black (3%), and mixed ethnicity (6%) women (the remaining 3% identified did not provide data on ethnicity). Of these women, the 23 who self-identified as heterosexual were included in the analyses reported below. Although my original power analysis called for a sample size of 100 female participants, due to the COVID-19 pandemic the sample size I was able to obtain was substantially smaller. Participants were primarily recruited through Humboldt State University's SONA research participant pool. Additional recruitment was done via the Behavioral Endocrinology Research Lab's twitter account.

Materials

Measures

Three questionnaires were used to assess social comparison tendencies in the current study:

The social comparison inventory (SCO; Buunk et al., 2006) is an 11-item scale designed to measure the tendency to compare oneself to others. Example items included "*I often compare how I am doing socially (e.g., social skills, popularity) with other people*" and "*I always pay a lot of attention to how I do things compared with how others do things.*" Scores on this scale can range from a possible 11-55, with higher scores indicating greater tendency to engage in social comparison. In the current sample, the

mean SCO score was 38.1 (SD = 8.7, range = 23-51), with Cronbach's alpha indicating excellent internal consistency (α = 0.90).

The intra-sexual competition scale (ISC; Buunk et al., 2009) is a 12-item scale designed to assess the degree to which an individual views confrontation in competitive terms with same-sex individuals. Example items include "*When I go out, I can't stand it when women/men pay more attention to a same-sex friend of mine than to me*" and "*I tend to look for negative characteristics in attractive men/women*". Scores on this scale can range from a possible 1-7, with higher scores indicating higher levels of self-reported intrasexual competition. In the current sample, the mean ISC score was 2.0 (SD = 1.0, range = 1.0-4.4), with Cronbach's alpha indicating excellent internal consistency (α = 0.90).

The physical appearance comparison scale (PACS; Schaefer et al., 2014) is an 11-item scale which measured individuals who compare their physical appearance to the physical appearance of others. Example items include, "*When I meet a new person (same sex), I compare my body size to his/her body*" and "*When I'm out in public, I compare my physical appearance to the appearance of others*". Scores on this scale can range from a possible 1-5, with higher scores indicating higher levels of comparison based on physical appearance. In the current sample, the mean PACS score was 2.7 (SD = 0.9, range = 1.2-4.2), with Cronbach's alpha indicating acceptable internal consistency (α = 0.74).

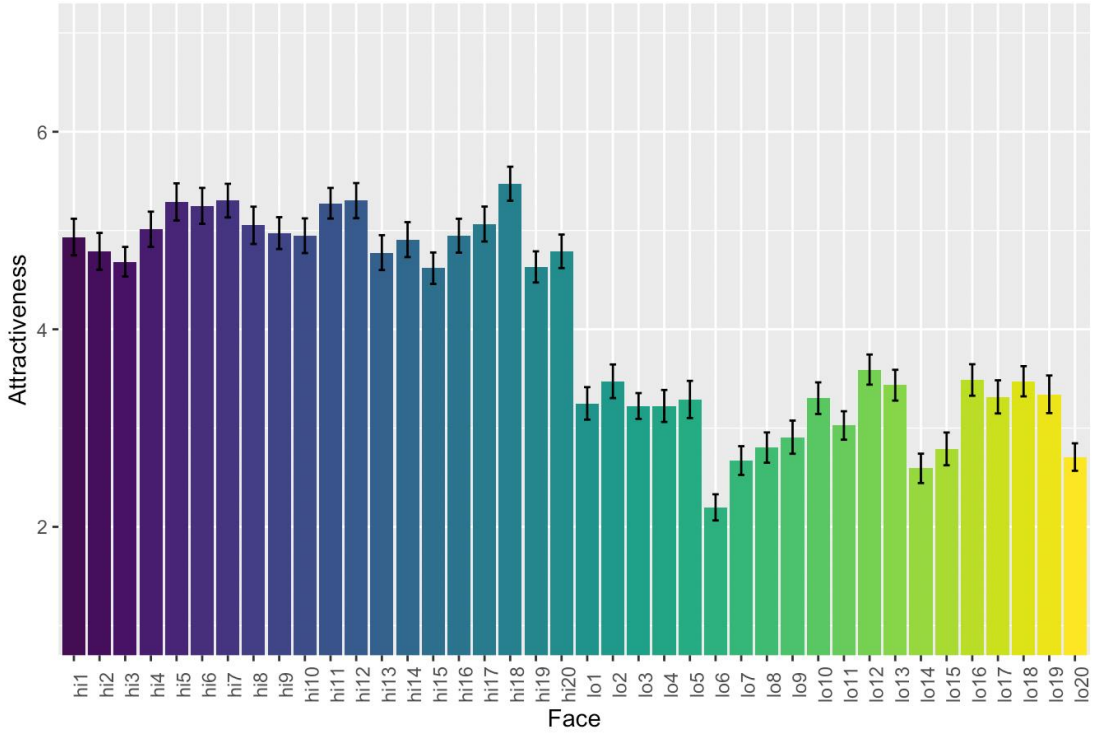
Stimuli

Following Levy et al. (2008), participants were presented with 40 female faces in the keypress task (described below); 20 of these were high attractive and 20 were low

attractive. These faces, described in a previous study (Hahn et al., 2013), were selected from a set of 62 Caucasian, adult female faces that were collected from various online sources (e.g., modeling websites, etc.). These faces were rated for attractiveness on a 7-point Likert scale where 1 = not very attractive and 7 = very attractive by 76 independent raters (17 men, 53 women, 6 did not report gender, age range 18-42 years). The 20 highest and 20 lowest rated faces were selected for use in the current study (see Figure 4 for visual representation of attractiveness ratings for the final image set used here).

Figure 4

Distribution of attractiveness ratings for each face presented in the keypress paradigm. Error bars reflect SEM.



A paired samples t-test confirmed that the high attractive faces (M = 5.00, SD = 1.52, $\alpha = 0.93$) were rated as significantly more attractive than the low attractive faces (M = 3.11, SD = 1.42, $\alpha = 0.93$; $t(19) = 18.57$, $p < .001$, $d = 4.15$). All faces were aligned on interpupillary distance and masked with a black background to remove the hair and neck. Images were displayed at a size of 300x400 pixels.

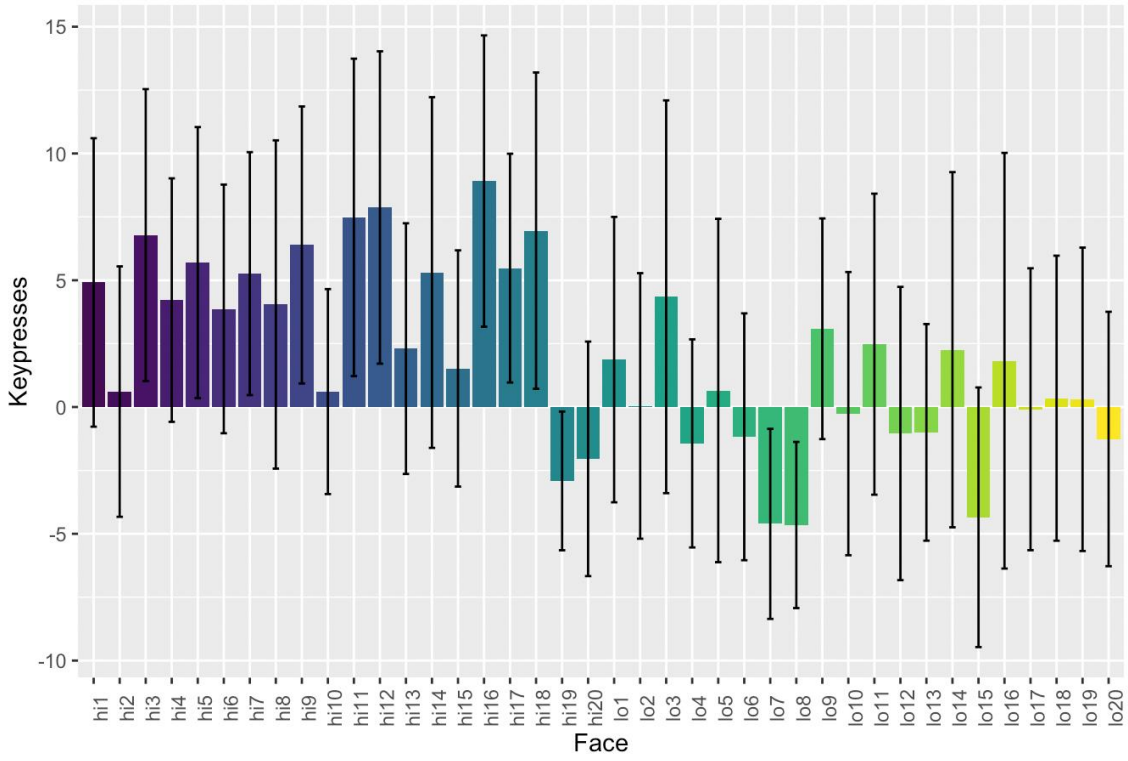
Procedure

Informed consent was obtained before subjects participated through an online consent form. Once consent was given, participants then completed the three questionnaires (listed in Measures section above), presented in a fully randomized order (i.e., the order of the questionnaires was randomized across participants as was the order of presentation of individual items within each questionnaire). Participants then completed a training session to familiarize them with the "pay-per-view" keypress task (designed to assess the reward value of facial stimuli; Aharon et al., 2001). This task allows participants to control the viewing duration of each image that was presented by pressing designated keys on their keyboard. This training task did not show faces, but rather utilized text-based images providing instructions for increasing or decreasing image presentation time. After training, participants completed the keypress task with the 40 female faces presented in a fully randomized order. Following Levy et al. (2008) and Hahn et al. (2016a), default viewing time was set to 4 seconds. The viewing time for any given face could be increased by alternately pressing keys 7 and 8 or decreased by alternately pressing keys 1 and 2 and each keypress pair altered the viewing time by 100ms. The average total task duration for the sample reported here was 160.1 seconds

(SD = 0.91, range = 159.3-163.5). During this task, participants were presented with the 40 female faces (20 attractive, 20 unattractive) in a fully randomized order (see Figure 5 for visual representation of the average number of keypresses exerted for each of these faces). Once participants completed the keypresss task, they were debriefed regarding the purpose of the study.

Figure 5

Average number of keypresses exerted for each face across participants. Error bars reflect SEM.

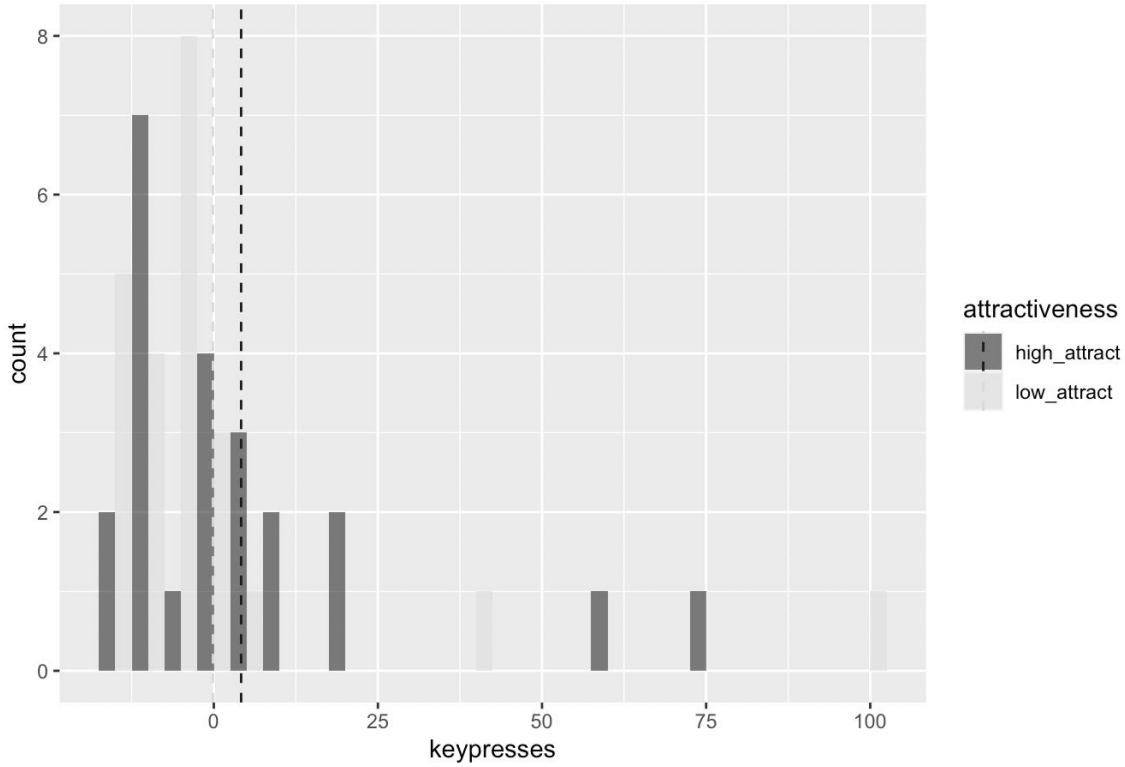


Results

First, the keypress data were assessed for normality (see Figure 6). (Bryne et al., 2010) recommends that data with a skewness outwith the range of -2 to +2 and/or kurtosis outwith the range of -7 to +7 should be considered to violate normality assumptions and likely needs to be subjected to transformation. Both skewness and kurtosis for both the high attractive (skew = 2.07, kurtosis = 6.68) and low attractive (skew = 3.30, kurtosis = 13.48) keypress scores were outwith this acceptable range.

Figure 6

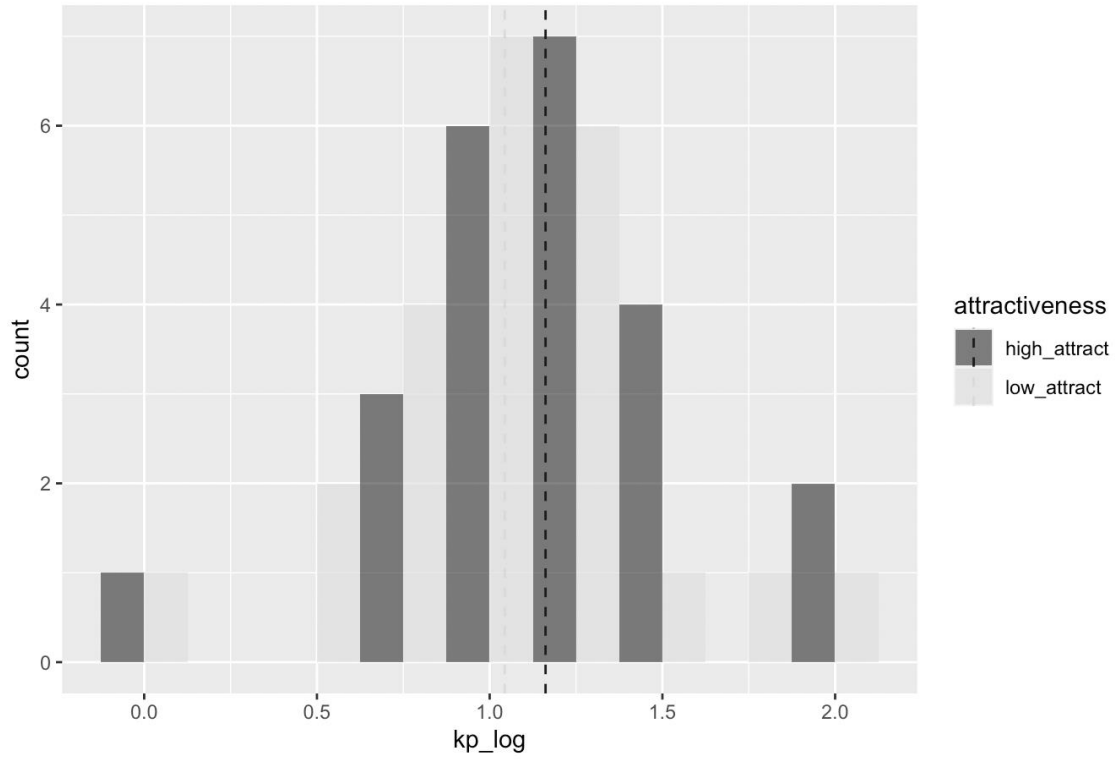
Histogram for keypress data. Dotted lines represent the mean for each attractiveness category.



Because the data did not fall within the skewness and kurtosis cutoff parameters for normality and was positively skewed towards the right both variables were subjected to a Log(10) transformation (following Hahn et al., 2013). Normality assessment on the transformed data (see Figure 7) indicated that skewness and kurtosis both fell within the acceptable range (high attractive: skew = 0.46, kurtosis = 4.06; low attractive: skew = 0.28, kurtosis = 4.33).

Figure 7

Histogram for log transformed keypress data. Dotted lines represent the mean for each attractiveness category.

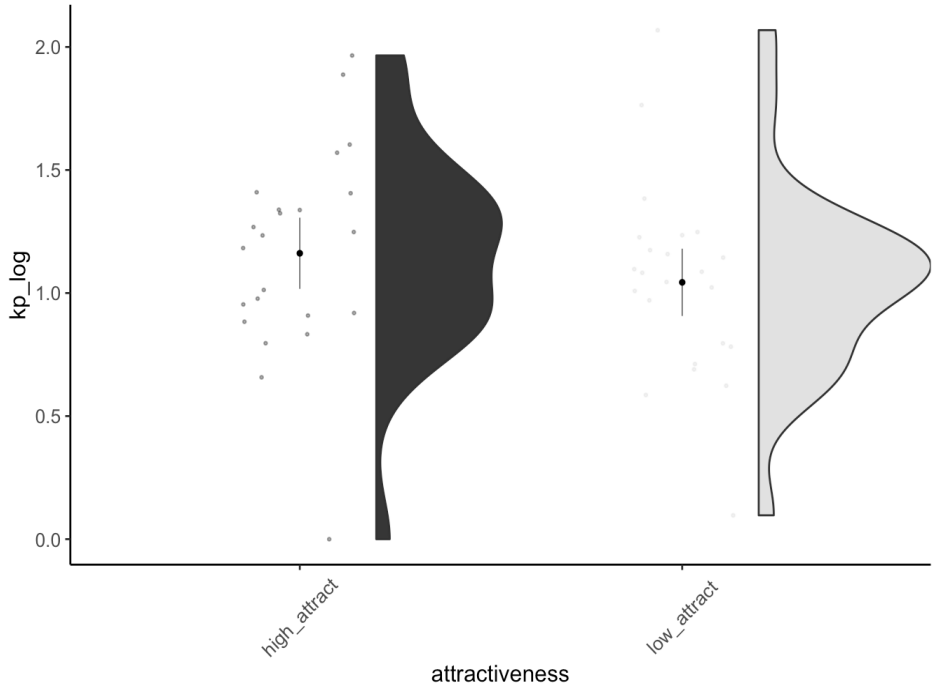


Testing Hypothesis 1: Replicating Previous Findings

Previously reported findings stated that, heterosexual women would exert greater effort (measured as number of keypresses) to view attractive female faces compared to unattractive female faces (Aharon et al., 2001; Hahn et al., 2013, Levy et al., 2008). A paired-samples t-test in the current data confirmed that women exerted greater effort via keypresses to view highly attractive female faces compared to low attractive female faces ($t(22) = 2.48$, $p = .021$, mean difference = 0.12, d = 0.52, see Figure 8). Therefore, the previously observed behavior whereby heterosexual women find same-sex beauty rewarding was replicated in the current study.

Figure 8

Violin plot illustrating the full distribution and average number of keypresses (log transformed) for the high attractive vs low attractive female faces.



Testing Hypothesis 2: Regression Analysis

The main analysis for this study was a multiple linear regression with the average number of keypresses for the high attractive female faces as the DV and scores on the social comparison orientation (SCO), physical appearance comparison scale (PACS) and intrasexual competition (ISC) questionnaires as its predictors. Analysis of the VIFs confirmed that there were no multicollinearity issues (all VIF < 4.1) and visual inspection of the residual plots confirmed there were no issues with homoscedasticity.

Contrary to my prediction, none of the social comparison measures significantly predicted the reward value of highly attractive female faces in the current data set (R^2 = .07, $F(3, 19) = 0.50$, $p = .69$, see Table 1). Bivariate correlations among the three questionnaire measures ranged from 0.72 - 0.85 (see Table 2). Rerunning these analyses with the untransformed (i.e., original) keypress data showed the same pattern of results.

Table 1

Linear regression analysis indicated that the reward value of same-sex beauty was not predicted by social comparison orientation (SCO), physical appearance comparison (PACS), or intrasexual competition (ISC).

	Estimate	Std. Error	*t* value	*p*-value
SCO	0.02	0.02	0.92	0.37
PACS	-0.01	0.20	-0.07	0.94
ISC	-0.09	0.14	-0.61	0.55

Table 2

Bivariate correlations among the survey measures: social comparison orientation (SCO), physical appearance comparison (PACS), or intrasexual competition (ISC).

	SCO	PACS	ISC
SCO	---	0.85***	0.74***
PACS	---	---	0.72***
ISC	---	---	---

*** $p < .05$

Discussion

The current study aimed to: (1) replicate the previously observed finding that same-sex beauty holds reward value among heterosexual women (e.g., Levy et al., 2008; Hahn et al., 2013) and (2) explore the potential impact of social comparison tendencies on the reward value of same-sex beauty among heterosexual individuals. To achieve these aims, a standard keypress task was used to gauge the reward value of same sex beauty of high attractive faces in comparison to low attractive faces in a group of heterosexual women. Each woman also completed a series of surveys to assess social comparison tendencies: the social comparison orientation (Buunk et al., 2006), the physical appearance comparison scale (Schaefer et al., 2014), and the intrasexual competition scale (Buunk et al., 2009).

As predicted, the previously observed finding that heterosexual women find same-sex beauty rewarding (Levy et al., 2008, Hahn et al., 2013, 2016a; Wang et al., 2014) was replicated in the current sample. Heterosexual women did in fact exert greater effort via the keypress task to view the highly attractive female faces in comparison to the low attractive female faces. This increased effort to view attractive female faces is thought to reflect that same-sex beauty is rewarding.

Having established that same-sex beauty was rewarding among the current sample of women, the next aim was to explore possible explanations for this finding. (Levy et al., 2008) previously argued that this reward value of same sex beauty observed among heterosexual women, but not heterosexual men, was due to the fact that heterosexual women have a “greater bisexual interest”. While there is some evidence

from sex research (e.g., Chivers et al., 2004) that supports this claim, it was not directly assessed by Levy and no alternative explanations were provided. Given that they don't offer any other alternative explanations, I hypothesized that this could at least in part could be due to social comparison tendencies, so I sought out to test that possibility. Previous neuroimaging research (Dvash et al., 2010; Fliessbach et al., 2007; Linder et al., 2014) has, indeed, suggested that the process of social comparison often involves similar brain regions that have been implicated in reward processing. Therefore, engaging in social comparisons could be rewarding and drive the motivation to exert effort to view same-sex beauty. However, contrary to my hypothesis, I did not find any evidence that social comparison tendencies predicted the reward value of same-sex beauty in the current sample of women. There are several possible explanations for the lack of relationship observed here.

Limitations and future directions

It is possible that there is a relationship between social comparison tendencies and the reward value of same-sex beauty that was unable to be detected in the current study due to a lack of statistical power. An initial power analysis called for a sample of 100 women, however I was only able to collect data from 37 women. The ongoing Covid-19 pandemic began when the study initially launched and impacted my ability to collect data. With this smaller sample, it is entirely possible that I was unable to detect a relationship that does exist. In order to confirm or refute this, a study using a larger sample of women is needed.

Second, it is possible that the materials utilized in the current study (i.e., the stimuli and the questionnaires) may have impacted my ability to detect a relationship between social comparison tendencies and the reward value of same-sex beauty. With respect to the stimuli used, individual differences in what is considered attractive could have played a role in how the participants perceived and responded to the stimuli. Although meta-analytic work (Langlois et al., 2000) suggests that there is a very high level of agreement across individuals and cultures regarding which faces are considered attractive, there is (of course) some degree of individual and cultural variation in these perceptions (e.g., Cunningham et al., 1995; Penton-Voak et al, 2004). Individual variation in attractiveness perceptions among the women sampled here could influence their desire to compare themselves with the faces they observed. Future research could better account for this issue by having the women rate the attractiveness of the faces themselves to confirm that they find the highly attractive faces attractive. With respect to the questionnaires used to measure social comparison, comparison of physical appearance, and intrasexual competition, some of the individual questions may have not been adequate in attempting to gauge this type of social comparison. Although there was high reliability for each scale, these types of self-report measures may not fully capture women's comparison behavior. It could also be that people aren't always honest in their responses - whether it's explicitly providing false responses or just an unawareness of oneself.. It may be that people do manage to socially compare themselves to others though they are not always explicitly honest or want to give socially desirable responses when engaging in the behavior. Future research could explore a more ecologically valid

measure of social comparison tendencies by asking others to report about the participant or by observing behavior more directly in some way.

Third, it is possible that the reward value of same-sex beauty among heterosexual women is actually due to a greater bisexual interest, as Levy et al (2008) claimed. Indeed, work by Baumeister et al. (2000) and Chivers et al. (2004) has shown that heterosexual women tend to display less category specificity compared to heterosexual men, showing a nonspecific pattern of arousal to sexual stimuli (i.e., attractive female faces). This reduced category specificity however, does not necessarily imply that heterosexual have "greater bisexual interest" with regards to their mate preferences. Research from Hahn and colleagues (2016a) demonstrated that although same-sex beauty is rewarding to heterosexual females, the reward value of facial attractiveness among was greater for preferred sex faces (i.e., male faces) than non-preferred sex faces (i.e., female faces). To clarify the potential role of category specificity, or "greater bisexual interest", future research needs to directly assess this factor by using a more nuanced measure of sexual interest/orientation and/or assessing the women's self-reported sexual attraction to each image.

Fourth, it may be the case that participants did not experience any form of social comparison because they might view themselves more attractive than the faces they were observing. Given that self-perceived attractiveness can be based on the observer's perception (Wade et al., 1997), participants might have a different view about their own level of attractiveness while viewing attractive same-sex individuals. Based on one's own level of attractiveness the stimuli presented could pose no threat or provide no learning

opportunity therefore, there is no need to engage in social comparison behavior. Or rather, participants may already experience low self-esteem and feel they cannot compete to that level of attractiveness. Festinger (1954) and Wheeler (1966) hypothesized there could be an upward drive involving social comparison tendencies. Where the comparison is paralleled with slightly better off others (i.e., highly attractive individuals). Studies have also shown contrast effects of viewing attractive or unattractive members of the same sex, whereby those viewing attractive members of the same sex show a decrease in self-esteem about their own attractiveness.

Fifth, it may be the case that women only engage in this form of social comparison to facilitate intrasexual competition at certain times. Many studies on female intrasexual competition have indicated that women often display enhanced intra-sexually competitive behavior around ovulation – a time when competition for access to mates would be most beneficial (e.g., Agthe et al., 2009; Durante et al., 2010; Fisher et al., 2004; Hahn et al., 2016b; Haselton et al., 2007). It is possible that women may find same-sex beauty more rewarding around ovulation, as they could be more likely to engage in social comparison to facilitate intrasexual competition at this time. A study conducted by (Wang et al., 2014) using this key-press task looked at how women's hormonal levels modulate the reward value of faces. Their results demonstrated that women's estradiol-to-progesterone ratio, considered a proxy for fertility or ovulation, modulated the reward value of female facial attractiveness. They also observed that women's testosterone levels, which have been positively linked to intra-sexual competition (Hahn et al., 2016b), predicted the reward value of female facial attractiveness – meaning that women

worked harder to view attractive conspecifics when their testosterone levels were higher. Together, these findings suggest that hormonal fluctuations could impact the reward value of same-sex beauty.

Conclusion

This study aimed to first replicate the previous findings that heterosexual women find same-sex beauty rewarding. Despite limitations (see above), the current study indeed revealed that same-sex beauty does, in fact, hold reward value amongst heterosexual women. The second aim was to see if women who worked harder to view the high attractive faces also tended to score high on the Social Comparison Inventory, the Intra-sexual Competition scale and the Physical Appearance Comparison scale. Hypothesizing that high scores from these surveys involving social comparison tendencies could perchance play a role in that reward value of sex-sex beauty. However, no relationship between any of these measures and the reward value of same-sex beauty was detected here. Future studies should seek to extend the current study by gathering a larger sample size and incorporating additional, potentially relevant, variables to see if a relationship may exist between aspects of social comparison tendencies and the reward value of same-sex beauty.

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