A Biometric Analysis of Mate Choice Copying in People

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/A Biometric Analysis of Mate Choice Copying in People/

by

Jonathan Lenhardt

A Master's Thesis Submitted to the Faculty of
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Psychology

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Abstract

Mate choice copying is the notion that a person or animal, after observing another choosing a romantic or sexual partner, will perceive that partner as more attractive and possibly attempt to acquire that same partner for themselves. Using measurement of pupil size in response to the presentation of pictures of men and women both alone and with a neutral or admiring partner, it was hypothesized that such a biometric measure could substantiate previous research that has supported the evidence of mate choice copying in people. This study's methodology complements that of previous studies utilizing questionnaires to measure the attractiveness of other individuals as well as behavioral ecology studies that examine this phenomenon in animals. The current study utilizes pupil dilation, which might serve as a proxy for physical attractiveness in humans and can be measured objectively. It was found that Likert ratings of attractiveness and pupil sizes are moderately correlated and that presenting a picture of another alongside a target face can increase the target face's attractiveness. The current research supports previous mate choice copying research and discusses implications for using pupillometry in studies that look at perception of attractiveness in people.
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Mate choice copying is the notion that a person or animal, after observing another choosing a romantic or sexual partner, will perceive that partner as more attractive and possibly attempt to acquire that same partner for themselves. Using measurement of pupil size in response to the presentation of pictures of men and women both alone and with a neutral or admiring partner, it was hypothesized that such a biometric measure could substantiate previous research that has supported the evidence of mate choice copying in people. This study's methodology complements that of previous studies utilizing questionnaires to measure the attractiveness of other individuals as well as behavioral ecology studies that examine this phenomenon in animals. The current study utilizes pupil dilation, which might serve as a proxy for physical attractiveness in humans and can be measured objectively. It was found that Likert ratings of attractiveness and pupil sizes are moderately correlated and that presenting a picture of another alongside a target face can increase the target face's attractiveness. The current research supports previous mate choice copying research and discusses implications for using pupillometry in studies that look at perception of attractiveness in people.
A Biometric Analysis of Mate Choice Copying in People

Mate choice copying is the notion that a human or animal utilizes a form of social learning that results in the higher probability of selecting a mate after observing another selecting that mate. Popular culture stereotypes suggest that a heterosexual male who is found attractive either by another woman or is in a relationship, engaged to be married, or currently married is more desirable than a heterosexual male who is single. It is also referred to as "the wedding ring effect" and is the subject of a great deal of anecdotal evidence among both men and women in today's society.

The topic of mate choice copying has been extensively described in nonhuman animals. Here, the same definition can be applied when analyzing the existence of this phenomenon. Research that has focused on mate choice copying in animals has examined how many different species react when one animal spots another mating. Behavioral ecologists have posited that darter fishes (Moran, Ende, & King, 2013), guppies (Godin & Hair, 2009), coral reef damselfish (Goulet & Goulet, 2006), ocellated wrasse (Alonzo, 2008) and Norwegian rats (Galef, Lim, & Gilbert, 2008) all consistently engage in mate choice copying. However, researchers (Drullion & Dubois (2008); Auld, Punzalan, Godin, & Rundle (2009)) have suggested that mate choice copying is much less predictable in other species such as zebra finches and fruit flies.

Unfortunately, there is significantly less research that focuses on mate choice copying in human than that in nonhuman animal behavior. For example, it was found a woman tended to copy the mate choice of another woman, but only if she was smiling when she looked at the man presented during the experiment (Jones, DeBruine, Little, Burriss, & Feinberg, 2007). If the woman was simply looking at the man with a neutral expression on her face, the
man's attractiveness was rated lower than in a control condition. Strangely enough, this research also found that men exhibited the opposite effect: Men rated a woman as more attractive if there was another man looking at her with a neutral expression and less attractive if that other man was smiling at her. It can be suggested that this is due to the perceived competition for a mate.

Researchers have also looked at mate choice copying in humans and how it is influenced by how attractive the man and woman were rated by participants. Waynforth (2007) found that, if a man who was initially rated as low in attractiveness was paired with a woman who was rated as highly attractive, that man's attractiveness rating increased more than if the woman finding him attractive was rated as less attractive. It would seem as if a woman finds a man more attractive if the woman with whom he is in a relationship is also seen as attractive.

By utilizing brief real life interactions, Uller and Johansson (2003) found that, by having single men wear a wedding ring under a false pretense, mate choice copying could not be induced. The study focused on ratings of physical, socioeconomic, and general attractiveness and found that ratings before and after the man-woman interaction were not significantly different for either in the control (no ring) or experimental (wearing a ring) conditions in how the women rated attractiveness of the man.

Place, Todd, Penke, and Asendorpf (2010) concluded that mate choice copying occurs in people when showing participants video footage of a man and woman interacting in a dating scenario. Oddly enough, using videos revealed that both men and women engage in mate choice copying and both sexes rate an individual as more attractive when another interacts positively in a mock dating scene. This is in contradiction to some of the previous
research cited above which indicated that mate choice copying does not occur in men. These researchers were also first to report that whether or not the participants were single or in a relationship did not affect the propensity to rate others in a relationship as more attractive.

When discussing mate choice in people, it is important to note that physical characteristics are not the only determining factor in evaluating the attractiveness of a candidate and that personality also plays an important role. Chu (2012) examined mate choice copying and integrated personality variables into this research area. Chu hypothesized that mate choice copying is limited in that it only occurs when the woman who is judging the attractiveness of the man likes the personality of the woman who is doing the initial assessment of that man. This research found that those women having a "pleasant character" (p. 694) were rated highly in attractiveness. Not only did previous research indicate that the physical attractiveness of the initial rater influences the participants' ratings, but so did ratings of "warmth."

One study instructed participants to read a short vignette about a fictitious male who was characterized as either single, in a relationship, or married and were asked to rate him on a variety of attributes (O'Hagen, Johnson, Lardi, & Keenan, 2003). After answering five questions related to the man's attractiveness, dating desirability, and partner potential, the researchers found that the females gave lower ratings to the man when he was described as currently in a relationship. When the man was described as married, women gave the man the lowest scores of all.

Based on the previous studies that looked at humans and mate choice copying, there is some disagreement as to whether or not mate choice copying actually exists, when it occurs, and who shows it. It is important to note that these studies have flaws and,
consequently, the current study plans on addressing these concerns by using a methodology that avoids questionnaires as the main method of inquiry into this complex phenomenon. With regard to personal issues such as attractiveness and human sexual behavior, Brink (1995) has found that participants frequently intentionally provided inaccurate data on surveys that dealt with suggestive topics. The researchers discussed such findings and suggested that sensitive or taboo subjects such as human sexuality can cause discomfort in participants and lead participants to give survey answers that are more socially acceptable. They also found that, despite the fact that surveys are completed anonymously and that confidentiality is maintained, participants are still uncomfortable with giving truthful responses. As a result of such findings, it is likely that questionnaires provide incomplete responses.

It is also worth mentioning that, although according to Fink, Neave, Manning, and Grammer (2006) there are common consistencies among ratings of attractiveness that examine facial symmetry, body shape, and skin, there is also much research that indicates a variety of factors that can influence one's rating of attractiveness. It was reported that ratings can be influenced by one's current level of life satisfaction (Jovanovic, Lerner, & Lerner, 1989). It was also found that "appeal" can influence ratings of self-judged attractiveness for men, but not for women (Downs, 1990). College students rate attractiveness in a subjective manner that is dependent upon their own sexual behavior and attitudes about sexuality (Weeden & Sabini, 2007). Lastly, it has been found that one's own ratings of sexual attractiveness can change with regard to social desirability as well as the rater's self-esteem (Longo & Ashmore, 1995). These studies raise a number of concerns regarding
questionnaires and studies that rely on participants rating the attractiveness of an individual in a laboratory setting.

The current study attempts to rectify limitations of the aforementioned studies on mate choice copying in humans by taking biometric measurement as an operational definition of attractiveness. Biometric methods are used for the identification of an individual through physiological measurement such as fingerprints, gait, or facial recognition. One type of biometric measurement pertains to the pupil in the eye and, according to Hess, Seltzer, and Shilien (1965) and Rieger and Savin-Williams (2012), pupil dilation in humans is positively correlated with perceived physical attractiveness when observing other human beings. In addition to increased ambient lighting, pupil dilation is also a reaction to seeing something that a person finds desirable and is exceedingly hard to consciously alter without the use of drugs. Thus, biometrics may be used to examine mate choice copying in humans and whether or not a person who is seen as attractive by one person is perceived as being desirable by a third individual. It is hypothesized that, although some research confirms and fails to confirm the existence of mate choice copying in humans, it does exist and can be quantitatively measured through the pupillary response.

Method

Participants

Participants were recruited from Montclair State University’s pool of undergraduate subjects who have signed up to fulfill psychology course requirements. Subjects were not screened for age, sex, race, sexual orientation, or any other attributes or demographic characteristics. For this study, 48 participants were recruited from PSYC 101 ("Introduction to Psychology") or PSYC 203 ("Introduction to Psychological Research") classes with the
aforementioned participant system. These are both required classes for undergraduates at this educational institution and constitute a representative sample of psychology undergraduates at a New York City area suburban campus (mean age = 19.48, SD = 1.94). Of the 48 participants, 8 (16.67%) identified their sex as male and 40 (83.33%) identified their sex as female.

Of the 48 participants who showed up for the study, one did not consent to the video recording. In addition, one participant did not provide any Likert ratings during the experiment and one participant hit the Num Lock key on the keyboard when rating attractiveness, causing all subsequent rating keypresses to not register. Lastly, one participant failed to keep her chin on the chinrest. These participants' data have been excluded from the analyses and the final sample size was 44 (mean age = 19.57, SD = 1.91), with 8 (18.18%) participants identifying his sex as male and 36 (81.82%) participants identifying her sex as female.

Materials

The stimuli used for this experiment was a series of pictures from the Karolinska Directed Emotional Faces (KDEF) set of facial images (Lundqvist & Litton, 1998). These pictures are of young, Caucasian, European adults from a Swedish university and are originally in color. Pictures of two men and two women were adopted from Jones, DeBruine, Little, Berriss, and Feinberg (2007). These particular men and women were chosen in the cited and current study for their similar levels of attractiveness, minimizing the possibility of ceiling and floor effects. These KDEF images were converted into grayscale photographs and their brightness was adjusted accordingly to account for any unwanted pupil changes that might occur from differing amounts of light from the image. These adjustments were made
by viewing each image in GNU Image Manipulation Program, acquiring color average values, and determining the appropriate brightness levels from the relative luminance formula $Y = 0.2126(R) + 0.7152(G) + 0.0722(B)$. These pictures were also resized from 562x762 to 169x229 pixels to ensure that participant focus was kept to a confined area when looking at the images.

The pictures used from the KDEF displayed both men and women from ages 20-29 looking left, right, and center while displaying a variety of emotions. For this experiment, pictures from four individuals (2 males and 2 females) and two emotion states (neutral for looking center and neutral or smiling for looking left) were presented to participants in the control condition. The control condition consisted of 12 pictures that were 169x229. See Appendix A for a breakdown of the pictures used here. For the experimental (or mate choice copying) condition, the author placed two pictures horizontally, yielding 24 pictures that were 338x229. Different combinations of stimuli in the mate choice copying conditions included whether the second picture is of a man or woman and whether he or she is smiling or maintaining a neutral facial expression. Preliminary testing by Jones, DeBruine, Little, Burriss, and Feinberg (2007) has shown that a scenario with individuals paired with a smiling face rather than neutral face are more likely to be interpreted as indicative of romantic interest, one of the necessities for invoking mate choice copying in people. Consult Appendix B for the pictures used here.

**Equipment**

A Sony Handycam HDR-CX240 with a 2.1-57mm f/1.9-4.0 lens at 4.0x zoom level was set to record at 1920x1080 progressive scan at 60 frames per second. Participants were presented with pictures on a 17" Dell UltraSharp 2007FB liquid crystal display (LCD).
display in-plane switching (IPS) computer monitor at 1024x768 and 60 Hz. As stated above, the brightness of the stimuli pictures was standardized to ensure that pupil dilation was not affected by differing light levels from the different picture sets. The room used for the experiment was a small windowless room in Dickson Hall at Montclair State University. Other equipment included a chinrest to ensure that participants would keep their heads stationary as they were presented the pictures. The distance between the chinrest and computer monitor was 19 inches and the camcorder was suspended 4 inches above and 2 inches behind the monitor using Joby Action Series camera mount. The chinrest and computer monitor's height were adjusted so that the participant's eye level was even with the pictures in the center of the monitor. The chinrest, computer monitor, and camcorder distances were not modified during the experiment.

The experiment was run on a Lenovo ThinkPad T61 laptop computer with a desktop keyboard and the Dell monitor connected via Universal Serial Bus (USB) and Video Graphics Adaptor (VGA), respectively. The laptop monitor was closed during the experiment to prevent any distractions or unnecessary light from affecting the participants' pupil size during presentation of the stimuli. The stimuli were presented using SuperLab 4.5. The software used to measure pupil size was TrackEye 2.0 (Zafer Savas). The editing of the video files was carried out with Sony Vegas Pro 12 and statistical analyses were conducted using International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) Statistics. The tables and figures used to elucidate analyses were drawn and modified using Microsoft Word 2010, Microsoft Excel 2010, IBM SPSS, and Microsoft Paint.
Design

The experiment was conducted in four phases. In the first phase, participants were shown 12 pictures of men and women alone and were asked to rate their physical attractiveness using a Likert scale ranging from 1 to 7. Ratings included the following: 1 = very unattractive; 2 = mostly unattractive; 3 = slightly unattractive; 4 = average; 5 = slightly attractive; 6 = mostly attractive; 7 = very attractive. In the second phase, the participants were presented with 24 paired pictures of men and women and were asked to rate the left (or target) pictures' physical attractiveness using the Likert scale previously discussed. The third phase was a pupillometry session that consisted of presenting participants with 12 pictures of men and women alone. The fourth phase was another pupillometry session in which had participants were presented with 24 picture pairs of men and women with the instructions to focus on the target picture. Order effects were controlled by randomizing not only the order of the four phases of the experiment but the order of each individual picture in each phase.

In all four phases, the pictures were presented to participants in a uniform way via the SuperLab program. In the pupillometry sessions, each picture was preceded by two seconds of gray-colored background with a focus point to ensure that a participant's pupil was at its baseline size (Rieger & Savin-Williams, 2012) and a 100-millisecond 1000 Hz tone was played. Afterwards, a picture displayed in the center of the screen against a slightly darker grayscale background (to control for pupil size changes that would occur from higher luminance). The picture lasted for two seconds and was followed by 500 milliseconds of a static/white noise image that was used to erase visual after effects. The duration from one stimulus to the next was 4.5 seconds and was used in all four phases for consistency. After
the four phases were completed, participants answered background questions that included their age and sex.

**Procedure**

Upon entering the laboratory, participants were asked to fill out an informed consent form for adults. This consent form (Appendix C) let participants know that there was minimal risk associated with the study and that they would be presented with a series of pictures of men and women alone and together while eye activity was recorded with a camcorder.

After signing the consent form, participants were led to the room where the experiment was conducted. The participant's chin was placed on the chinrest and the experimenter made sure that the camera was focused on the eye region of the participant's face. The camcorder was set to record and the experiment program was started on the laptop before closing its display. The lights in the room were turned off. The experimenter left the room and did not contact the participant until the experiment was completed. The outside door to the main hallway was also closed to minimize auditory distractions.

After the experiment was completed, the participant met with the experimenter to ensure that no problems were encountered throughout the duration of the experiment. A copy of the informed consent form was given for the participant to keep, the participant was thanked, and the experimenter gave the participant credits for partaking in the experiment.

The SuperLab data file was exported into SPSS. Using Sony Vegas Pro, the video files were divided into 4-second H.264 MPEG-4 AVC files that showed the participants' pupil size after the stimulus was presented in the two pupillometry phases of the experiment. The presentation of each picture had been paired with a tone that was used to allow the
The experimenter knew where to crop the video files. The information in the SuperLab data file was used to determine which video file went with which stimulus picture when analyzed with TrackEye 2.0.

The TrackEye program was used to accurately measure the pupil size after being presented with the pictures of men and women alone and in pairs. The default options were used with the exception of checking the "Track eyes in detail" option for the pupil measurements. The video files were inserted into the program manually and the values given in the program for "Left Pupil radius = x" and "Right Pupil radius = x" were doubled, averaged, and inserted into the SPSS spreadsheet for pupil diameter. These values represented the number of pixels that the pupil occupied in each of the video files when each picture was presented to each participant.

**Results**

**Men and Women Alone Survey**

In phase one of the experiment, participants were asked to rate the physical attractiveness of 12 pictures of 2 men and 2 women looking left and maintaining a neutral or smiling facial expression or looking center and maintaining a neutral expression (see Appendix A). The Likert scale ratings are shown in Table 1.

A 2 (Sex of stimulus: male, female) x 3 (Type of picture: *FRONT, *HAPPYLEFT, *NEUTRALLEFT) within-subjects analysis of variance was conducted to determine whether or not any differences existed between the ratings of the pictures presented in this phase of the experiment. It was found that pictures that featured smiling faces were rated as more attractive than those with a neutral facial expression, \( F(5,41) = 3.53, \ p = .01 \), regardless of the sex of the person in the picture. A comparison of the male and female picture ratings
revealed that there was no difference, $F(1,41) = .088$, $p = .77$, indicating that participants did not differ in their ratings when they were presented with a picture of a man or a woman.

**Men and Women Pairs Survey**

In a second phase of the experiment, participants were instructed to provide Likert scale ratings of attractiveness to the person on the left of 24 pictures of men and women together (see Appendix B). As Table 2 shows, the Likert scale mean ratings of attractiveness of the target person increased when displaying them alongside another person from the KDEF.

A series of independent samples t-tests were utilized to analyze the existence of Likert rating differences between singular and paired pictures. It was found that pairing F1FRONT with a picture of a smiling or neutral female face resulted in Likert ratings that were significantly greater, $t(43)=2.61$, $p = .012$ and $t(43)=2.49$, $p = .015$. When paired with male faces, participants did not rate F1FRONT as any more attractive, all p-values > .05. F2FRONT was rated as more attractive when paired with a picture of a smiling or neutral female face, $t(43)=2.34$, $p = .02$ and $t(43)=2.01$, $p = .048$. Again, all pairings with male faces resulted in no significant differences in Likert ratings. For M1FRONT, ratings were higher when paired with only the F1 pictures for both the smiling and neutral conditions, $t(43)=2.49$, $p = .015$ and $t(43)=2.45$, $p = .02$. All other p-values were found to be nonsignificant. Lastly, M2FRONT was not rated as more attractive by participants in any of the conditions.

**Men and Women Alone Pupillometry**

In a third phase of the experiment, participants were asked to observe pictures of men and women alone while a video camera recorded their pupil activity (see Appendix A). The mean pupil diameter (in pixels from a 1920x1080 video file) are shown in Table 1.
Another 2 (Sex of stimulus: male, female) x 3 (Type of picture: FRONT, HAPPYLEFT, NEUTRALLEFT) within-subjects analysis of variance was conducted to determine whether or not any differences existed between participant pupil diameter measurements when presented with pictures in this phase of the experiment. It was found that, very much like the previous section concerning Likert scale ratings of the same pictures, the pictures that featured smiling faces were associated with greater pupil dilation, $F(5,41) = 10.40, p = .001$, regardless of the sex of the person in the picture. A comparison of the male and female picture ratings revealed that the greater pupil dilation that occurred when looking at pictures of men approached significance, $F(1,41) = 3.28, p = .07$, but ultimately indicated that participants did not differ in their physiological response when they were presented with a picture of a man or a woman.

**Men and Women Pairs Pupillometry**

In a fourth phase of the experiment, participants were asked to focus on the left person in pictures that feature men and women together (see Appendix B). As Table 3 shows, the participant mean pupil diameters are now different than when the participants were presented with singular pictures. These diameter measurements from the TrackEye program hint at the possibility that a participant tended to find the pictures of the F1FRONT, F2FRONT, M1FRONT, and M2FRONT individuals more attractive when they were pictured alongside another neutral or smiling face.

An independent samples t-test was chosen to analyze the pupillometry data present in this phase of the experiment. Significant participant pupil dilation occurred when F1FRONT was presented alongside F2HAPPYLEFT and F2NEUTRALLEFT, $t(43)=3.41, p = .001$ and $t(43)=3.20, p = .002$. Other face combinations that F1FRONT was paired with resulted in no
pupil size differences. For F2FRONT, it was found that pairing the face with another smiling or neutral female face resulted in participant pupil dilation, t(43)=2.78, p = .01 and t(43)=2.01, p = .049, respectively. When paired with a male face, there were no significant differences. Participant pupil size increased when M1FRONT was presented alongside F1 and F2 smiling and neutral faces, t(43)=3.50, p = .001, t(43)=3.18, p = .002, t(43)=2.66, p = .009, and t(43)=2.49, p = .01, with less significance for M2HAPPYLEFT and M2NEUTRALLEFT pictures, t(43)=2.24, p = .03 and t(43)=2.14, p = .04, respectively. Lastly, significant pupil dilation occurred when participants viewed M2FRONT alongside happy and neutral faces of F1 and F2, t(43)=2.38, p = .02, t(43)=2.20, p = .03, t(43)=1.9947, p = .0492, and t(43)=1.9901, p = .0498. Pupil sizes for pairing with male faces resulted in p-values > .05.

**Likert Rating and Pupil Size Correlations**

To examine the relationship between mean Likert ratings and mean pupil sizes when presented with single and paired pictures, a bivariate analysis was performed. As detailed in Figure 1, a moderate correlation between mean Likert ratings of physical attractiveness and mean pupil size in pixels was found to exist in the singular pictures used in this experiment, r(42) = .57, p < .05. When it came to pairing two individuals alongside one another, it was also found that a moderate correlation exists between Likert ratings and participant pupil sizes, r(42) = .48, p < .05 (see Figure 2). A combined plot of single and group Likert ratings and pupil measurements can be found in Figure 3.

**Discussion**

It was hypothesized that, in accordance with previous research, mate choice copying can be invoked and measured using Likert scale ratings and physiological measures by
showing participants pictures of men and women with another person. Based on the above analyses, the previous claims that mate choice copying exists in people can be partially substantiated. It was found that the physical attractiveness ratings of the female faces (F1FRONT and F2FRONT) were found to be rated significantly more attractive only when paired with another female face. Likewise, the attractiveness ratings of the male faces (M1FRONT and M2FRONT) were only significantly more attractive when also paired with female faces. It was also found that being pictured alongside a smiling female face (such as F1HAPPYLEFT) increased attractiveness ratings even more, similar to previous research by Jones, DeBruine, Little, Burriess, and Feinberg (2007). As the cited study suggests, romantic interests and mate choice copying effects are strongest when one picture is being smiled at by a picture of a female individual.

Although almost all of the faces enjoyed a small attractiveness rating boost from being paired with another person, many of these differences did not reach statistical significance. Other newer studies have suggested that simply pairing another with many faces of any sex induces a "cheerleader effect" that causes everyone to be rated as more attractive (Osch, Blanken, Meijs, & Wolferon, 2015; Walker & Vul, 2014). However, it is worth noting that these two studies looked at much larger groups of individuals to discern this effect. It is quite possible that the differing means but nonsignificant results from the current study are reflective of a miniature cheerleader effect that would be amplified and significant if more than two men or women were pictured together.

It is of paramount importance to not only look at self-report surveys as previous studies have done but to discuss the findings that surfaced when one took a biometric approach to the concept that one can become more attractive when their picture is alone
versus paired with another individual. This study is unique in that it builds on research that has indicated that pupil dilation serves as a reliable proxy for ratings of physical attractiveness in people (Hess, Seltzer, & Shlien, 1965; Rieger & Savin-Williams, 2012).

In the current study, it was found that the female faces (F1FRONT and F2FRONT) caused significant pupil dilation only when pictured with another female face. The male faces (M1FRONT and M2FRONT) also caused significant dilation of participants' pupils only when pictured with female faces as well. However, in the pupillometry sections of the experiment, the pupil dilation was more pronounced when the target face was male rather than female, indicating that mate choice copying attributes of attractiveness are greater when dealing with male faces being accompanied by female faces than vice versa. The stereotypes previously alluded to in the introductory section of the paper that suggest that married men or men who are simply being admired by a woman are seen as more attractive seems to ring true in an experimental laboratory setting. It is unknown why the mate choice copying effect for males is stronger only when looking at pupil sizes than self-report surveys. The other face combinations showed differences from the alone conditions but did not reach significance, similar to the findings presented with the questionnaires.

It has been suggested in previous research that participants are frequently not honest on surveys when it comes to issues of human sexuality or sexual attraction (Brink, 1995). As indicated from this cited study, these hang-ups can be personal or societal and adversely impact what one might say they find physically attractive on a questionnaire and what they actually find attractive through a physiological measure that is much more difficult to fake. By looking at Figure 3, one can observe that mean pupil size and mean Likert ratings are moderately positively correlated both for single pictures, \( r(42) = .57, p < .05 \), and for group
pictures, $r(42) = .48$, $p < .05$. Employing a line of best fit shows that intersection occurs with single or group pictures that are rated at 3.9 or a pupil size of 91 pixels. Participants presented with pictures of people who were less attractive tended to give Likert ratings that were higher than what their biometric measurements revealed. However, when participants were presented with pictures that were more attractive, they tended to rate them lower than what their physiological measurements suggested.

It can be suggested that the intersection and differing correlations that exist in Figure 3 insinuate that self-report answers of physical attractiveness and physiological measurements do not match up, moreso when a person's attractiveness is evaluated in a group as opposed to alone. It is speculated that this may be due to participant perception of peer pressure that cause group Likert and pupillometry evaluations to be less consistent than individual Likert and pupillometry evaluations. Since it is not socially acceptable by many to evaluate the physical attractiveness of another harshly and possibly give low ratings in the Likert ratings part of the experiment, discrepancies can result.

**Limitations**

First and foremost, it is worth noting that a computer monitor and video camera are not optimal devices for the measurement of pupil diameter. Hardware solutions such as the EyeLink 1000 have resulted in more published studies than similar camcorder setups that are used in this experiment. The reliability of using a camcorder and TrackEye 2.0 to determine pupil size is less established than more expensive equipment used in past psychological research. However, such devices often involve a steep learning curve and the utilization of a camcorder that can be acquired at an electronics retailer makes this pupillometry research
more readily available to one who does not have access to more sophisticated eye tracking equipment available at an educational institution.

Another limitation pertains to the design of the study. The SuperLab program that was used in the current study randomized the order of the four phases as well as each individual picture that was present in each phase. As a result, order effects were not taken into consideration. It is possible that a future study may wish to utilize a more complicated Latin square design but it is difficult to tell exactly how the results of such a study would differ from the current one. Nonetheless, it would be pertinent to take such ideas into considerations in a follow-up investigation.

The participants used in this study were overwhelmingly female and it is possible that this is the reason for the resulting lack of significance when pairing target faces with male faces. Previous research has found that male participants rated female faces as less physically attractive when presented with a male face (Jones, DeBruine, Little, Burriss, & Feinberg, 2007). In the review of the previous literature, the researcher suggested that this may be due to intrasexual mate competition forces. The current study found that Likert scale ratings of female faces did not decrease (but rather enjoyed a modest but nonsignificant increase) when paired with a male face. It is possible that this is due to a lack of male participants to sway Likert ratings accordingly to fully replicate previous findings. When drawing from a population that tends to skew female (such as undergraduate psychology classes), it is best for a future study to ensure equal numbers of both men and women through some sort of participant screening.

This study does not examine sexual orientation of the participants. A future study should focus include the participant's sexual identity and evaluate how that changes the
answers given in the self-report parts of the experiment and their physiological responses during the pupillometry sections of the study. It was found by Hess, Seltzer, and Shlien (1965) and Rieger and Savin-Williams (2012) that not only is pupil size correlated with physical attractiveness of presented pictures (as stated above), but this pupil activity is dependent upon the sexual orientation of the participant being shown the images. It is possible that, when accounting for differing sexual orientations, more intricate and more significant results can be found among the different combinations of male and female faces that were presented in the current study. As previous research has found that a person's own relationship status can influence ratings of physical attractiveness of others (Sacco, Jones, DeBruine, & Hugenberg, 2012), it can be suggested that a future study should ask participants about their own romantic life.

One final limitation of the current research is that it employs a smaller set of images than previous research by Jones, DeBruine, Little, Burris, and Feinberg (2007). This smaller set was chosen when the experimenter factored in time constraints associated with creating the different combinations of paired images and showing each participants all of these images. It is possible that the effects shown in the current study were minimized by choosing only two pictures of men and two pictures of women. A future study might also use images from the Karolinska Directed Emotional Faces (KDEF) set of facial images but choose to present participants with a larger sample of images in an effort to maximize the effects shown in the current research.

Conclusion

The current study is important in that it is the first to utilize biometrics (pupillometry, in this case) in an effort to look at the claims behind mate choice copying in humans. The
complementary usage of physiological measures in addition to self-report surveys is novel and allows one to uncover discrepancies in which pictures of men or women one claims are attractive with a Likert scale and how a person responds physiologically to these same pictures.

The use of questionnaires is highly dependent upon the honesty of the individual that is completing them. Certain sensitive areas (such as one's own sexuality or human sexuality in general) are believed to invoke temptations of lying in an effort to make one feel a certain way about oneself or to impress researchers analyzing the data or fellow friends and peers. As a result of this, it is hoped that the current study advocates a departure from the questionnaire and into the utilization of measurements that are more dependent upon involuntary changes that occur in the individual. It is posited that this will help to further scrutinize or replicate past psychological research and offer new methods by which to learn about how the human mind works and the multitude of interconnections that exist within the social and natural sciences.
References


Rieger, G., & Savin-Williams, R. (2012). The eyes have it: sex and sexual orientation

doi: 10.1371/journal.pone.0040256


Table 1  

*Mean Likert Scale Ratings and Mean Pupil Size in Pixels of Single Pictures*

<table>
<thead>
<tr>
<th>Picture</th>
<th>Likert Rating M (SD)</th>
<th>Pupil Size M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1FRONT</td>
<td>3.60 (0.91)</td>
<td>90.17 (4.03)</td>
</tr>
<tr>
<td>F1HAPPYLEFT</td>
<td>4.12 (1.07)</td>
<td>91.21 (2.12)</td>
</tr>
<tr>
<td>F1NEUTRALLEFT</td>
<td>3.72 (0.94)</td>
<td>88.74 (1.91)</td>
</tr>
<tr>
<td>F2FRONT</td>
<td>3.40 (1.11)</td>
<td>88.12 (5.21)</td>
</tr>
<tr>
<td>F2HAPPYLEFT</td>
<td>4.10 (1.18)</td>
<td>91.78 (2.45)</td>
</tr>
<tr>
<td>F2NEUTRALLEFT</td>
<td>3.56 (0.87)</td>
<td>89.74 (1.82)</td>
</tr>
<tr>
<td>M1FRONT</td>
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<td>90.87 (3.72)</td>
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<tr>
<td>M1HAPPYLEFT</td>
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<td>92.45 (1.93)</td>
</tr>
<tr>
<td>M1NEUTRALLEFT</td>
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<td>90.80 (1.98)</td>
</tr>
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<td>M2FRONT</td>
<td>3.71 (1.01)</td>
<td>89.44 (4.23)</td>
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<td>4.17 (0.98)</td>
<td>91.92 (2.44)</td>
</tr>
<tr>
<td>M2NEUTRALLEFT</td>
<td>3.50 (1.04)</td>
<td>90.87 (2.23)</td>
</tr>
<tr>
<td></td>
<td>M2NEUTRALLEFT</td>
<td>M2HAPPYLEFT</td>
</tr>
<tr>
<td>-------</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>(10.1') 65' 3' 0'</td>
<td>4.01 (1.21)</td>
<td>3.76 (1.21)</td>
</tr>
<tr>
<td>(60.0') 88' 3' 2'</td>
<td>(9.47)</td>
<td>3.85 (1.01)</td>
</tr>
<tr>
<td>(80.1') 10' 3' 4'</td>
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<td>4.24 (1.0)</td>
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Paired with picture

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<tr>
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<th>PHAPPYLEFT</th>
<th>FNEUTRALLEFT</th>
<th>PHAPPYLEFT</th>
<th>FNEUTRALLEFT</th>
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<td>3.60 (0.91)</td>
<td>3.60 (0.91)</td>
<td>3.60 (0.91)</td>
<td>3.60 (0.91)</td>
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<td>3.60 (0.91)</td>
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<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
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Mean Likert Scale Ratings of Picture Pairs

Table 2

Running head: BIOMETRICS OF MATE CHOICE COPYING

27
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<th>M</th>
<th>M</th>
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<th>0.05 &gt; d **</th>
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<td>4.32</td>
<td>91.05</td>
<td>4.25</td>
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<tr>
<td>93.28</td>
<td>4.32</td>
<td>91.19</td>
<td>4.12</td>
</tr>
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<td>97.29</td>
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<td>94.91</td>
<td>4.12</td>
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</tr>
<tr>
<td>93.87</td>
<td>4.31</td>
<td>90.02</td>
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Paired with picture

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<th>Alone</th>
<th>M (SD)</th>
<th>M (SD)</th>
<th>M (SD)</th>
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<tr>
<td>96.17</td>
<td>0.03</td>
<td>88.01</td>
<td>5.21</td>
</tr>
<tr>
<td>96.98</td>
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<tr>
<td>93.87</td>
<td>4.31</td>
<td>90.02</td>
<td>4.72</td>
</tr>
</tbody>
</table>

Mean Pupil Sizes in Pixels of Picture Pairs

Table 3
### Table 4

*Mean Likert Scale Ratings and Mean Pupil Sizes in Pixels of Picture Pairs*

<table>
<thead>
<tr>
<th>Picture</th>
<th>Likert Rating</th>
<th>Pupil Size</th>
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<tr>
<td>F1FRONT_F2HAPPYLEFT</td>
<td>4.17 (1.13)</td>
<td>93.28 (4.52)</td>
</tr>
<tr>
<td>F1FRONT_F2NEUTRALLEFT</td>
<td>4.13 (1.08)</td>
<td>93.01 (4.30)</td>
</tr>
<tr>
<td>F1FRONT_M1HAPPYLEFT</td>
<td>3.85 (0.82)</td>
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<tr>
<td>F1FRONT_M1NEUTRALLEFT</td>
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<td>F1FRONT_M2HAPPYLEFT</td>
<td>3.91 (1.14)</td>
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<tr>
<td>F1FRONT_M2NEUTRALLEFT</td>
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<td>3.79 (1.18)</td>
<td>89.12 (4.52)</td>
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<td>4.21 (0.92)</td>
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<td>M1FRONT_M2NEUTRALLEFT</td>
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<tr>
<td>Condition</td>
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<td>Median (SD)</td>
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<td>-------------------------------</td>
<td>------------</td>
<td>--------------</td>
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<tr>
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<td>90.91 (2.45)</td>
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<td>90.21 (3.97)</td>
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<tr>
<td>M2FRONT_M1NEUTRALLEFT</td>
<td>3.89 (1.01)</td>
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</tr>
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</table>
Figure 1. Correlation between the mean Likert scale ratings of physical attractiveness as given by participants and their mean pupil size in pixels while viewing singular pictures.
Figure 2. Correlation between the mean Likert scale ratings of physical attractiveness as given by participants and their mean pupil size in pixels while viewing group pictures.
Figure 3. A combination of the previous two figures for illustrative purposes only.
Appendix A

F1FRONT

F1HAPPYLEFT

F1NEUTRALLEFT

F2FRONT

F2HAPPYLEFT

F2NEUTRALLEFT

M1FRONT

M1HAPPYLEFT

M1NEUTRALLEFT

M2FRONT

M2HAPPYLEFT

M2NEUTRALLEFT
CONSENT FORM FOR ADULTS

Please read below with care. You can ask questions at any time, now or later. You can talk to other people before you sign this form.

**Study's Title:** A Biometric Analysis of Mate Choice Copying in People

**Why is this study being done?** The following study is being done to determine how one's pupil size reacts to pictures of men and women. This pupil size is one facet of biometrics, or the measurement of biological data.

**What will happen while you are in the study?** In this study, you will be instructed to place your chin on the designated chinrest and observe a series of stimuli (in this case, pictures) on a computer monitor. In the meantime, a camcorder will record your eye movement. This movement will be analyzed after the study is done to determine if the claims behind mate choice copying can be substantiated through biometrics.

**Time:** This study will take about fifteen minutes. This is the only session.

**Risks:** You may feel uncomfortable from sitting unusually still for the duration of the experiment. Other than this, the risks are no greater than those in ordinary life.

Although we will keep your identity confidential as it relates to this research project, if we learn of any suspected child abuse we are required by NJ state law to report that to the proper authorities immediately.

**Benefits:** The knowledge that you have advanced the field of psychology through a juxtaposition of the natural and social sciences.

**Compensation:** You may benefit from this study by receiving two credits from the SONA research participant system for the class(es) that you are currently enrolled in.

**Who will know that you are in this study?** You will not be linked to any presentations. We will keep who you are confidential.

**Do you have to be in the study?** You do not have to be in this study. You are a volunteer! It is okay if you want to stop at any time and not be in the study. You do not have to answer any questions you do not want to answer. Nothing will happen to you.

**Do you have any questions about this study?** Email the principal investigator, Jonathan Lenhardt, at lenhardtjl@montclair.edu or the faculty sponsor, Dr. Peter Vietze, at vietzep@montclair.edu.
Do you have any questions about your rights as a research participant? Phone or email the IRB Chair, Dr. Katrina Bulkley, at 973-655-5189 or reviewboard@mail.montclair.edu.

<table>
<thead>
<tr>
<th>As part of this study, it is okay to videotape me:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please initial:       Yes       No</td>
</tr>
</tbody>
</table>

**One copy of this consent form is for you to keep.**

**Statement of Consent**
I have read this form and decided that I will participate in the project described above. Its general purposes, the particulars of involvement, and possible risks and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time. My signature also indicates that I am 18 years of age or older and have received a copy of this consent form.

<table>
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<tr>
<th>Print your name here</th>
<th>Sign your name here</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jonathan Lenhardt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of Principal Investigator</td>
<td>Signature</td>
<td>Date</td>
</tr>
</tbody>
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<tr>
<th>Name of Faculty Sponsor</th>
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<tr>
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