ATTRACTIVENESS OF WOMEN IN RED

AS AN AUTOMATIC PHENOMENON

By

Ana Montano

Submitted to the

Faculty of the College of Arts and Sciences

of American University

in Partial Fulfillment of

the Requirements for the Degree

of Master of Arts

In

Psychology

Chair:

Anthony H. Ahrens, Ph.D.

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Dean of the College of Arts and Sciences

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ABSTRACT

The purpose of this study was to test whether there is an automatic basis for the effect of the color red on attractiveness. Participants performed two tasks intended to measure automatic judgments of attractiveness and automatic willingness to approach or avoid a stimulus. They were shown pictures of women wearing red and women wearing blue and I hypothesized that men would judge pictures of women wearing red as more attractive, as previous studies have shown. However, the results did not support the hypothesis and participants rated women wearing blue more positively than women wearing red, with no gender difference. The results are explained partially by an implicit preference for the color blue alone. Though the hypothesis was not supported, the study supports the use of the Affect Misattribution Procedure as an implicit measure of judgment of visual stimuli.

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INTRODUCTION

Folk wisdom holds that “beauty is in the eye of the beholder,” but what kinds of factors influence what people consider beautiful? Recent research has shown that aside from facial characteristics and general physical attributes, peripheral factors may influence judgments of attractiveness. For example, the color red enhances judgments of attractiveness (Elliot & Niesta, 2008).

Why red? Certainly, all colors have many associations. Often, the color white is associated with being pure and clean. The color blue can be associated with relaxation or peace, and sometimes sadness, while the color green is sometimes associated with nature and trees and creates soothing emotions. And the color red can signify danger, passion, love, arousal, or anger (Kaya & Epps, 2004).

Depending on the context in which the color red appears, studies have shown that its mere presence can produce context-consistent feelings and behavior. One such study found that perception of the color red before an important test impairs performance (Elliot, Maier, Moller, Friedman, & Meinhardt, 2007).This is an instance in which red is associated with danger of failure and avoidance motivation, which is likely learned in school, where red signifies “wrong.” In an effort to expand this research, Elliot & Niesta (2008) found that red in a romantic context affects attractiveness judgments.

Red's Association with Love and Sex

The color red has a strong and clear association with passion, lust, and love. Research has shown that the origin of this correlation could stem from a number of different sources.

On one hand, red has an evolutionary purpose in nature and that is usually attraction. Sexual swelling and redness to convey fertility or attract mates is present in 10% of primates (Caro, 2005). Carnivorous plants display red coloration, which has been shown to increase capture rates of prey (Schaefer & Ruxton, 2008). While this is not a sexual attraction, it is still a demonstration of how the color red serves the purpose of attraction in general. One study by Gerald, Waitt, Little and Kraiselburd (2007) even showed that when presented with digitally enhanced pictures of other monkeys, rhesus macaques fixate their gaze longer for reddened female faces and hindquarters. Though the exact function of this reddening has not been determined, many researchers agree that it acts a sexual signal to attract mates (Deschner, Heistermann, Hodges, & Boesch, 2004).

A much more subtle but similar effect is seen in human females. During the middle of the sexual cycle, women respond more easily to sexual stimuli (Slob, Bax, Hop, Rowland, & van der Werflen Bosch, 1996). This means that the reddening of sexual arousal and flirtatious blushing are more likely to occur during this time. While facial redness is a much more subtle display of the color, studies manipulating texture and color of faces have found it is associated with judgments of health and healthier faces are perceived as more attractive (Jones, Little, Burt, & Perrett, 2004; Stephen, Coetzee, Law

Smith, & Perrett, 2009). Studies like this suggest that an overt display of the color red, like a red blouse or dress, should reasonably influence ratings of attractiveness.

In addition to red as a biological marker of attraction, socially the color red is frequently paired with romantic and sexual stimuli and has been throughout history. The color red was considered a symbol of love by the Greeks and in Judaism. In ancient China, brides wore red and red firecrackers were used at the ceremony (Dreyfuss, 1984). In modern day society, the color red is seen on boxes of chocolates and flowers on Valentine's Day – a day of love and romance. The red rose, for example, is considered a symbol of love and given on special occasions to loved ones (Sebeok & Danesi, 1999). In the media, sexy female leads are portrayed in red or wearing red lipstick. And often times when the frumpy girl is transformed into a sex symbol, as is the case in movies like *Pretty Woman* and *She's All That*, she emerges wearing a red dress. Red, as in red-light district, is also used to designate neighborhoods where sex shops exist or prostitution takes place. Red, as a subtle signal for sexuality, is abundant.

How Red Affects Attractiveness Judgments

The strong association between the color red and sex or attractiveness could be a result of the evolutionary or social presence of red, or the combination of both. This is what Elliot and Niesta (2008) call the "red-sex link." This association explains findings like those in a study in which participants were shown colors and asked to create associations (Kaya & Epps, 2009). As expected, the color red was associated with romance and love and several studies have shown that this holds true cross-culturally. Red is associated with love across cultures more than any other color (Aslam, 2006).

Another study done with Portuguese participants found that red was associated more with Eros love- extremely passionate and intense love- than were the eleven other colors tested (Neto, 2002).

Elliot and Niesta (2008) sought to examine whether or not wearing the color red or simply being pictured in front of a red background would influence men's ratings of women's attractiveness. They performed a series of experiments in which pictures of women, in which color was prominent either as the background of the picture or on the women's shirts, were presented to participants. Red was compared against white, gray, blue and green. The latter three colors were chosen because they could be equated to red on chroma, or saturation, and lightness. In all trials, women pictured in front of a red background or wearing red were rated as being more attractive and more sexually appealing compared to woman pictured with other colors. Male participants also displayed greater interest in dating them as well as greater willingness to spend money on a date.

An awareness probe demonstrated that participants were unaware of the purpose of the experiment and they did not believe that color had any influence on their judgments. This suggests that the effect of the color red occurs on an automatic level without deliberate consideration when making judgments of attractiveness.

This finding has been replicated and has been shown to occur in ratings by males or females of a male target wearing red as well (Roberts, Owen, & Havlicek, 2010). This same effect was not present in women's ratings of other women. This could be partially explained by research that has shown that males rely more heavily on visual cues in sexual contexts than women (Havlicek, Saxton, Roberts, Jozifkova, Lhota, Valentova, &

Flegr, 2008). However, that does not fully explain why female judgment of male targets is influenced by shirt color. Roberts and colleagues (2010) suggest that women may be sensitive to but simply not use these visual cues when making intrasexual judgments.

Wearing black, as well as red, also leads targets to be perceived as more attractive (Roberts, Owen, & Havlicek, 2010). This could be due to the fact that the authors had targets photographed wearing each of the different shirt colors, which could introduce variability if the way they were posed or their facial expressions varied slightly while wearing different color shirts. Though subtle, any variations may have appeared more attractive for reasons other than the color shirt they were wearing. This highlights the importance of using digitally altered copies of the same photo, to reduce the possibility that slight variations in facial expressions could account for results.

A study by Kayser, Elliot and Feltman (2010) found that the prime is even strong enough to influence behavior, not just judgments of attractiveness. In one experiment, they found that men chose to ask women wearing red more intimate questions than women wearing green. In another experiment, they chose to sit closer to an interaction partner wearing red than one wearing blue. These findings demonstrate the strength of the red effect. The fact that it has proven so pervasive across situations and that it is significant enough to not only affect perception, but also behavior, suggests that it could be a fully automatic behavior.

Automaticity

Automaticity refers to any process that does not require conscious effort. Automatization of a process occurs after the frequent, consistent use of that process,

either intentionally or incidentally (Bargh & Chartrand, 1999). The same way riding a bicycle becomes automatic, frequently pairing two separate concepts leads to an automatic association of those concepts in the mind.

Among other things, automatic processes can influence evaluations and judgments, which could partially explain the results of the studies demonstrating that ratings of attractiveness are affected by the presence of the color red. Tests, like the Affect Misattribution Procedure (AMP), have been developed to measure these implicit attitudes (Payne, Cheng, Govorun & Stewart, 2005). The AMP allows us to determine whether attitudes about a stimulus are implicit, which is what the present study seeks to find with relation to the color red and judgments of attractiveness.

The test makes use of people's misattribution of positive or negative reactions from one source for another – in the case of the AMP, from a prime image to a Chinese character. It consists of a computer task during which the prime photographs are presented, followed by a Chinese pictograph. Participants are instructed to judge the Chinese character as either pleasant or unpleasant. Participants were more likely to judge a character following a positive prime photo as pleasant and similarly, more likely to judge a character following a negative prime photo as unpleasant. This effect occurred regardless of whether or not participants were warned about the possible biasing effect the prime photograph might have. In other experiments, Payne and colleagues(2005) found that the AMP was sensitive to racial and political attitudes, including voting intentions. It was shown to be highly reliable and valid, by comparing AMP responses to self-reported attitudes.

In addition, the AMP has been shown to be sensitive to judgments of facial attractiveness (Cheng, Chartrand, & Ferguson, 2008). Participants were given the AMP with attractive, unattractive or neutral faces as primes. These faces had been previously matched on emotionality and age. They found that each group was judged as significantly different on attractiveness from the others and participants were more likely to judge Chinese characters that were preceded by attractive faces as "pleasant" and least likely to judge the characters as "pleasant" when preceded by unattractive faces. This study not only shows that we make automatic evaluations of others based simply on facial attractiveness, but also that the AMP is sensitive to these automatic judgments.

Automatic processes can also influence action and behavior, which could explain why participants get closer to a confederate wearing red. A study by Cacioppo, Priester, and Berntson (1993) demonstrated that muscle movement was associated with evaluation of a stimulus. They found that participants liked stimuli more when their arm was flexed, which is a state associated with pulling, than if their arm was extended as if pushing something away.

In a study that reversed the directionality of this logic, Chen and Bargh (1999) hypothesized that automatic evaluation would lead to behavioral tendencies to avoid or approach the stimulus. They had participants respond to stimuli by pulling or pushing a lever. Those in the motion congruent condition were instructed to push the lever away – a representation of avoiding behavior - when they saw a negative stimulus and to pull the lever – a representation of approaching behavior – when presented with a positive stimulus. In the motion incongruent condition, the instructions were reversed and they had to pull for negative and push for positive. They found that when responding to

negative stimuli, such as cancer, they were faster at pushing the lever away – a congruent motion – and similarly, when responding to positive stimuli, such as puppy, they were faster to pull the lever.

The Red Effect as an Automatic Process

The literature has sufficiently demonstrated that the perception of attractiveness as well as behavior associated with attractiveness judgments is affected by the presence of the color red, but not how or why. I posit that the combination of societal exposure and evolutionary purpose of the color red in conjunction with sexuality is so deeply ingrained that the priming effect is reflexive. I expect that judgments of attractiveness, as shown in the aforementioned studies, are automatically affected by the color red.

This so-called red-sex link could be explained as a preconscious act that develops with repeated mental associations between the color red and sex. In other words, if men consistently make an association between the color red and sex or love, then conscious choice becomes unnecessary and they will associate the two automatically. This is unlikely to be a result of intentional acquisition becoming an automatic process, because it would be unrealistic to assume that most people purposefully mentally associate the two as an aid for judging potential mates' attractiveness. It is more logical that the automatization occurs unintentionally as a result of repeated association, which explains how the effect develops.

Our biological predisposition to use the color red to attract attention could create a preference for mates wearing the color red which is reinforced by its societal use in conjunction with passion, love and lust. Using Bargh and Chartrand's (1999) conception

of what makes a psychological process automatic, it is reasonable to assume that this effect has become automatic for people.

The present study seeks to expand this line of research by attempting to demonstrate that judgments are made with little or no conscious intention. No research before this has used implicit priming procedures to gather judgments of attractiveness.

HYPOTHESIS

Consistent with the previous literature, I predicted that male and female participants will show significant differences in the effect of color on attractiveness ratings. More specifically, I expected male participants to demonstrate an automatic preference for women wearing red versus blue as determined by scores on the AMP (Affect Misattribution Procedure) and latencies in an approach-avoid joystick task. I predicted that women will not show the same bias.

Simply put, (1) on average, on the AMP, I expected males to judge Chinese characters preceded by photos of women in red as more “aesthetically pleasant” than photos of women wearing blue. (2) I expected women to show no significant differences on AMP judgments of Chinese pictographs preceded by either women wearing red or women wearing blue. (3) I anticipated that men will be faster at pulling the joystick when seeing a picture of woman in red, rather than when seeing a woman in blue. (4) I did not expect women to show significant differences in pushing latencies when observing women in red or blue.

METHOD

Participants

Participants were recruited online using postings on the school's daily electronic newsletter, Today@AU, and on campus at American University. Those recruited on campus were given flyers with information about how to sign up to participate and those that were willing were brought into the lab to complete the study. There were a total of 49, with 21 males and 28 females. They ranged from 18 to 32 in age with a mean and median of 20 years old. The demographic breakdown was 71.4% Caucasian, 8.2% African-African American, 10.2% Hispanic, and 10.2% Native American. Because of the use of Chinese characters in the AMP, those who reported that they were familiar with Chinese or Japanese were excluded from the study. Participants also had to have normal color vision, which we checked using the Ishihara color-blindness test (Ishihara, 1987). They were compensated for participation with partial course credit, extra credit or $5.

Measures

The present study involved both the AMP as well as a joystick task to measure judgments of attractiveness. Color was varied within-subjects with sex as a between subjects variable. The order of the tasks and the order of the push/pull instructions were counterbalanced for each participant. For each approach-avoid task, participants were shown the motion congruent instructions– pulling when seeing red, the theoretically positive stimulus-and the motion incongruent instructions –pushing when seeing red.

This counterbalancing was intended to reduce any order effects that might result from performing one task before the other every time.

Apparatus and Stimuli

The study was completed on three *Dell Optiplex 780* desktop computers running Windows XP Professional. The different tasks were presented using MediaLab and DirectRT software. For the approach-avoid task, participants used a *Logitech Attack 3* gaming joystick.

The stimuli for the computer tasks were pictures of women, with digitally manipulated clothing. A total of 18 pictures were used, each shown wearing either blue or red.

Pilot Tests

Prior to the study, 86 pictures of Caucasian women obtained from the internet were pilot tested for the study. The pictures were rated on attractiveness on a scale of 1 (very unattractive) to 7 (very attractive). The participants for this study were 35 American University students: 19 males and 16 females, who were given $5, extra credit or course credit for their participation. The 18 target photos chosen for the study were rated on average as slightly above average, as Elliot & Niesta used in their study, with a range of ratings from 4.23 to 4.97 and were chosen on the basis of lighting and clarity, as well as photos for which the shirts were sufficiently visible.

In another set of pilot tests, the colors blue and red were matched on brightness and saturation to ensure that the chosen colors of red and blue differed from each other only on hue. A solid red color was created on *Microsoft Paint* with a hue of 0, saturation

of 240 and luminance of 90 and then tested against different blues to determine which was perceptually matched. In this test, eight participants were shown two blocks of color, one blue and one red, and were instructed to indicate if they were the same in brightness, with each square presented five times. The proportion of times each blue square was perceived as being the same as the red one across the five trials for each participant and across the eight participants was calculated. Blue squares with a luminance of 80 were perceived the same as the red color 80% of the time, so this was used as the level of brightness. In a separate test, the color squares were matched on saturation. Nine participants were shown red and blue squares and asked to indicate which appeared to have the same level of saturation, or purity. The highest proportion of perceived matched saturation was a blue square with a saturation of 150. We then digitally manipulated the shirt color of all the women in the photograph so each one would appear twice, once wearing red and once wearing blue.

Procedure

After completing the informed consent form, participants were seated at a desktop computer equipped with a joystick. Instructions for each of the tasks were given on screen and before each AMP or approach-avoid task participants were given practice trials to get accustomed with how to properly respond.

During the AMP, participants were shown pictures of women wearing a blue or red shirt and they were instructed to judge the Chinese character as pleasant or unpleasant. They were told that the prime images were there to serve as a warning that the Chinese pictograph was about to appear and they were instructed to not do anything

with those pictures. Each picture appeared on the screen for 75 ms followed by a blank screen for 125 ms. A random Chinese character then appeared for 100 ms. Then participants saw a picture of black and white "noise" until they responded. Each trial would begin as soon as the previous trial was completed. There were 18 photo stimuli in total, each depicting a different woman. Each woman appeared once in a red shirt and once in a blue shirt, for a total of 36 trials. The background in all photos was black, and the only color present was the red or blue in the shirts. The photos were presented in a random order.

During the approach-avoid joystick task, the same pictures were shown. Participants during this task were instructed to pull or push when they saw a woman in red or blue. Pulling when seeing a woman in red represents the motion congruent condition since that was expected to create more positive evaluation than a woman in blue. During the first block of trials, each of the 18 women appeared once in red and once in blue for a total of 36 trials. After the initial 36 trials, the instructions would switch for another 36 trials. The presentation order was random.

Participants also completed both the AMP and the joystick tasks with red and blue squares to obtain a baseline measure of people's responses to red and blue colors. This was done prior to presenting the tasks with the picture stimuli and served as practice trials to get participants accustomed to the procedure.

After these tasks, participants were to rate colors on a scale from 1 to 7 intended as self report measures of color preference. They were given a color blindness test and a short demographics questionnaire. They were debriefed on the computer and verbally upon completion of the study.

RESULTS

AMP

The AMP data was averaged into two variables: an average proportion of pleasant ratings for women wearing blue and for women wearing red (see Table 1). Preliminary data analysis showed that the scores were slightly left skewed for both groups though there were no apparent outliers. In addition, 14 participants chose pleasant for every trial presented and one chose unpleasant for every trial.

Table 1

Descriptive Statistics for the AMP

	Gender	Mean	Standard deviation
Blue shirt	Male	.7593	.2232
	Female	.6389	.2459
	Total	*.6905*	*.2416*
Red shirt	Male	.6878	.2719
	Female	.5952	.2721
	Total	*.6349*	*.2731*
Blue square	Male	.6706	.1553
	Female	.6027	.2071
	Total	*.6318*	*.1879*
Red square	Male	.5060	.1977
	Female	.4881	.2130
	Total	*.4957*	*.2047*

The data was analyzed using a repeated-measures ANOVA with shirt color as a within subjects variable and gender as a between subjects variable to test the hypothesis that males would find women in red as more attractive than women in blue. There was a significant main effect for shirt color: $F(1, 47) = 7.634$, $p < 0.01$, with an eta squared of 0.140. However, contrary to my hypothesis, participants preferred women wearing blue to women wearing red. The test of between-subjects effects showed no significant main effect of gender, $F(1, 47) = 2.277$, $p = 0.138$ and an eta squared of 0.046. There was also no significant interaction between the two variables, $F(1, 47) = 0.445$, $p = 0.508$, with an eta squared of 0.009.

As shown in Figure 1, comparison of the means of the data for shirt color and color squares showed a possible interaction. The preference for blue over red appears to be stronger for the squares than for the pictures. This could indicate an effect of the color red for attractiveness that is somewhat masked by overall preference of the color blue. Therefore, it might be important to control for the underlying color preference, seen in judgments of the squares, in considering the ratings of pictures.

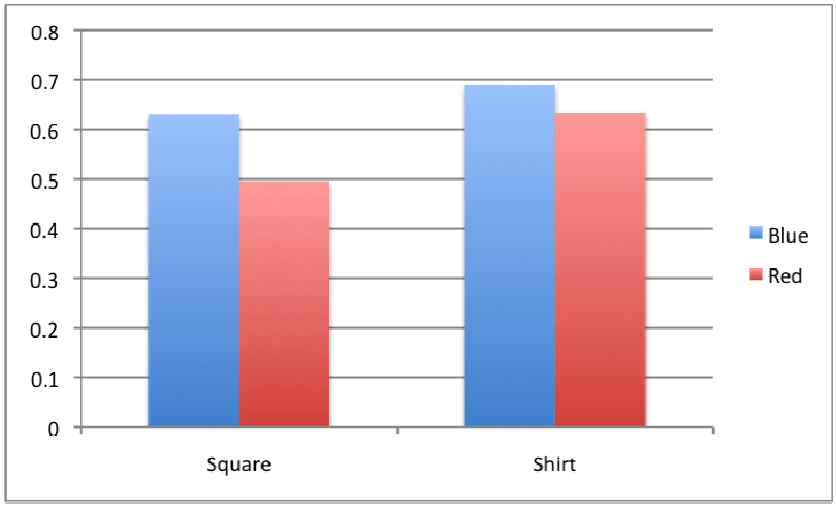

Figure 1.Graph of AMP Mean Proportions of Pleasant Ratings.

I analyzed the color square data using an ANOVA. The effect of color was significant, $F(1, 47) = 8.350$, $p < 0.006$, with a mean proportion of pleasant ratings for blue of .637 and for red of .497. The interaction between gender and square color was not significant, $F(1, 47) = .269$, $p = .607$. There was also no significant effect of gender, $F(1, 47) = 2.048$, $p = .159$. In order to control for the preference for blue, I performed a repeated measures ANCOVA on the data using both color square data variables as covariates. Gender was a between-subjects variable and color a within-subjects variable. The main effect of shirt color was no longer significant after controlling for square color preferences, $F(1, 45) = 0.002$, $p = 0.968$ and there was no main effect of gender, $F(1, 45) = 1.788$, $p = 0.188$. Finally the interaction between gender and shirt color was still not significant, $F(1,45) = 0.212$, $p = 0.647$.

Given that one of my hypotheses was that men would prefer red, I conducted an exploratory ANOVA comparing just the males on the AMP. The effect of color was

significant, $F(1,45) = 5.498$, $p = 0.029$, with participants preferring blue over red just as the ANOVA demonstrated for all participants. Likewise, after controlling for color square data, the effect of color was no longer significant, $F(1,18) = 0.955$, $p = 0.341$.

In addition, 14 of the participants had an average score of 1 or 0, indicating that they rated pictures in all trials as pleasant or unpleasant. In order to see whether this was due to the order in which the measures were presented, I compared the participants that had the AMP first to the ones that had the AMP second in the study. All but two of the cases were in the condition that performed the AMP after the approach avoid task, suggesting that perhaps participant fatigue was the reason why they made the same response for all trials. Results for Fischer's exact test were significant with $p = 0.002$, indicating that participants who completed the AMP after the approach-avoid task were more likely to use unvaried responses. Out of the 26 participants that had the AMP after the approach avoid task, 13 of them had constant pleasant or unpleasant responses. The AMP was then analyzed omitting the 15 cases that rated everything as pleasant or unpleasant. The results of this were the same as the results that included those cases.

A *t*-test was performed to ensure that the participants who did not have differentiated responses on the AMP were not significantly different when replying on the approach avoid task. There was no significant difference on reaction time based on the order of presentation, $t(47) = 1.213$, $p = .276$.

Approach- Avoid Task

The data for the approach-avoid task was analyzed for normalcy. Table 2 shows the averaged latencies for each of the four trials: push for red, pull for red, push for blue,

pull for blue. All four groups were unequally distributed with most latencies clustered around the means and a skew toward longer latencies. Consistent with Chen and Bargh (1999), cases that were over 4000 ms were omitted as outliers before averaging. Only two trials out of 3528 individual trials were removed.

Table 2

Descriptive Statistics for the Approach-Avoid Task When Shown Pictures of Women in red or Blue

	Gender	Mean (in ms)	Standard deviation
Average Red/Pull Latency	Male	693.0087	163.3365
	Female	635.1429	120.5732
	Total	*659.9425*	*141.8832*
Average Red/Push Latency	Male	734.1799	197.5111
	Female	690.3115	135.9986
	Total	*709.1122*	*164.7402*
Average Blue/Pull Latency	Male	687.8333	157.0797
	Female	640.8690	121.0231
	Total	*660.9966*	*138.0977*
Average Blue/Push Latency	Male	728.1060	162.6129
	Female	711.7738	147.0846
	Total	*718.7733*	*152.4915*

The data was analyzed using repeated-measures ANOVA with color and instruction as within subjects variables and gender as a between subjects variable. There was a significant main effect of the joystick instructions, $F(1, 47) = 30.999$, $p < 0.001$ with a tendency to pull faster than push overall. This had an eta squared of 0.391. There

was no significant main effect of color, $F(1,47) = 0.160$, $p = 0.691$. There was no significant main effect of gender, $F(1, 47) = 1.217$, $p = 0.276$. The interaction between instruction and color was not significant, $F(1, 47) = 0.049$, $p = 0.825$. The interaction between color, instruction and gender was also not significant, $F(1, 47) = 0.062$, $p = 0.805$. All effect sizes other than that of the instructions were under 0.05.

As with the AMP, participants also completed the task with blue and red squares in place of women wearing each color and this data (Table 3) was used as a covariate in a repeated measures ANCOVA along with gender as a between subjects variable and the effect of shirt color as a dependent variable. The covariate variable was calculated by subtracting the difference between pulling for blue and pushing for blue from the difference between pulling for red and pushing for red. A total of 46 trials (1.3%) were removed from the 3528 trials of the square data that were above 4000 ms. There was a main effect of instruction, $F(1, 43) = 27.321$, $p < 0.01$, with participants faster to pull than push over trials, 663.69 and 715.45, respectively. There was no main effect of shirt color, $F(1, 43) = 0.524$, $p = 0.473$. There was no main effect of gender, $F(1, 43) = 0.820$, $p = 0.370$. The interaction between shirt color and instruction was not significant, $F(1, 43) = 0.102$, $p = 0.751$ The interaction of color, instruction and gender was not significant, $F(1, 43) = 0.294$, $p = 0.590$.

Though the ANOVA for the full approach avoid task was not significant, an ANOVA comparing the latencies for pulling for blue squares and pulling for red squares had a significant main effect of color, $F(1, 47) = 4.196$, $p = .046$, with participants overall faster to pull for blue squares than pull for red squares, with mean latencies of 694.03 and

743.53, respectively. There was no main effect of gender, $F(1, 47) = .166$, $p = .685$, and no significant interaction between gender and color, $F(1, 47) = .065$, $p = .799$.

Given this effect of color on pulling latency for squares, I conducted another ANOVA comparing the latencies just for pulling for red shirts and pulling for blue squares had no significant main effect of color, $F(1, 47) = .000$, $p = .988$ or gender, $F(1, 47) = 2.179$, $p = .147$. The interaction between gender and color was not significant, $F(1, 47) = .085$, $p = .771$.

Table 3

Descriptive Statistics for Color Square Trials of the Joystick Task

	Gender	Mean (in ms)	Standard deviation
Average Red/Pull Latencies	Male	754.4739	201.2258
	Female	732.5817	142.4555
	Total	*741.9641*	*168.5424*
Average Red/Push Latencies	Male	719.7349	205.6987
	Female	703.6708	133.6231
	Total	*710.5554*	*166.5473*
Average Blue/Pull Latencies	Male	698.7977	167.8784
	Female	689.2662	123.8404
	Total	*693.3512*	*142.8021*
Average Blue/Push Latencies	Male	760.6642	230.0868
	Female	691.9559	139.4924
	Total	*721.4023*	*184.8884*

Self Report

Participants rated the extent to which they liked 11 different colors, including blue and red, on a scale of 1 to 7. This data was analyzed using a repeated measures ANOVA, there was a significant main effect of color, $F(1, 47) = 14.866$, $p < 0.001$ with a higher mean preference for blue. The tests of between subjects effects showed no main effect of gender, $F(1, 47) = 1.352$, $p = 0.251$. The interaction was not statistically significant, $F(1, 47) = 0.532$, $p = 0.469$.

Correlations of Measures

In order to determine if the implicit measures used in the study correlate with participants' self reports of color preference, we calculated correlations of the different measures of color preference. A total of five variables were computed to determine if this was the case. If the implicit measures are correlated with each other and the explicit measure, these variables, calculated using the differences of the ratings of blue and ratings of red, should correlate with each other, as well.

For the AMP, a variable was computed by subtracting the proportions of pleasant ratings of blue shirts from red shirts. Another variable was computed using the blue and red color squares by subtracting the proportions of pleasant ratings of blue squares from red squares. For the approach-avoid task, the variable was computed by subtracting the difference between pulling for blue and pushing for blue from the difference between pulling for red and pushing for red. Like the AMP, this was computed separately for the shirts and color squares. For the self report measure, the rating of blue was subtracted

from the rating for red. Finally, two variables were computed for just the pull latencies: one for squares, computed by subtracting pulling for blue from pulling for red and another for shirts, computed the same way. For the computed self-report variable and the two AMP variables, negative numbers indicated more preference for blue. For the computed approach-avoid task variables, positive numbers indicate a greater preference for blue, since faster latencies are indicative of preference.

The results are reported in Table 4. The AMP color squares differences were correlated with the self report differences, $r(49) = 0.496$, $p < 0.001$. The joystick square differences were correlated with the joystick shirt differences, $r(49) = 0.335$, $p = 0.019$. The joystick pull latencies for squares were correlated with AMP shirt, AMP square, joystick shirt and joystick square. The joystick pull latencies for squares were also correlated with joystick shirt, joystick square as well as the joystick pull square variable. All other correlations were not significant.

Table 4

Pearson Correlations for Explicit and Implicit Measures

		AMP shirt	AMP square	Joystick shirt	Joystick square	Self report	Joystick pull square	Joystick pull shirt
AMP shirt	Correlation	1						
AMP square	Correlation	.194	1					
Joystick shirt	Correlation	-.016	.010	1				
Joystick square	Correlation	-.247	-.248	.335*	1			
Self report	Correlation	.260	.496**	-.113	-.166	1		
Joystick pull square	Correlation	-.352*	-.295*	.365**	.863**	-.178	1	
Joystick pull shirt	Correlation	-.073	.037	.844**	.422**	.037	.452**	1

*Note. *p< .05* **p< .01

DISCUSSION

The results of the present study showed a preference for blue compared to red in the AMP and self report measures. The approach avoid task only in part corroborated these findings. Neither of the measures demonstrated the preference for women wearing red, specifically from males, that was hypothesized. The results of the approach-avoid task did not show, as hypothesized, that males would be faster to pull when seeing women wearing red rather than women in blue.

The fact that the hypothesis was not supported could indicate that the effect of the color red on attractiveness that has been demonstrated in other studies does not occur automatically. If this were true, that means that there is no automatic process behind the effect of red when we make judgments of attractiveness. Given the fact that red has been shown to affect judgments of attractiveness in prior studies, this would suggest that people deliberately take shirt color into consideration when making judgments of attractiveness.

According to prior research, this is unlikely to be the case since awareness probes showed that people are not consciously aware of red having any effect on their judgments (Elliot & Niesta, 2008). In addition, failure to reject the null hypothesis cannot be used to conclusively say that the null hypothesis is false. Below, I will discuss some methodological and sampling factors may be the reason why the null hypothesis was not rejected. The small number of males used in the study may have reduced the ability to

see an effect. In addition, the implicit methods used may not have been appropriate for testing ratings of attractiveness.

Though the hypothesis was not supported, the current study demonstrated that the AMP is an appropriate way to implicitly measure preference for visual stimuli such as color since it accurately reflected self reported color preference. Since the AMP is an implicit measure, the preference for blue and women wearing blue demonstrated in the study suggests that there is an automatic component to judgments of visual stimuli including colors. In addition, the preference for blue demonstrated on the color square AMP was consistent with self report measures. This correlation was expected since color preference is not something one would expect people to be motivated to conceal. This provides support that color preference is accessible both implicitly and explicitly and can be measured accordingly.

Prior findings have shown that the AMP is sensitive to judgments of attractiveness, though that could not be corroborated with this study (Cheng, Chartrand, & Ferguson, 2008). Though there was a main effect of shirt color for the AMP and women in blue were perceived as more pleasant, this data cannot be used to say conclusively that women in blue are perceived as more attractive than women in red since the preference for the color blue could be primarily responsible for the way the women were rated. When the color square data was used to control for color preference in the repeated-measures ANOVA, there was no difference between preference for red and blue.

The results of the approach-avoid task did not support the hypothesis that men would be faster to pull for women wearing red than they would pull for women wearing blue. It also did not reflect the preference for blue that was seen in the AMP and in the self report measure of color preference. In addition, joystick color square data was only correlated with the joystick data for shirts. It was not correlated with the AMP measures or the self report measure of color preference. This could also be an indication that this measure is not appropriate for use with this kind of research. One possible reason is that the comparison stimuli using in this study do not have an adequate positive or negative valance to show a difference. The stimuli used in prior research with the measure are more clearly positive or negative, such as words like “cake” and “guns” (Chen & Bargh, 1999; Bargh,, Chaiken, Govender, & Pratto, 1992). Different colors and photos matched on relative attractiveness may be too neutral relative to each other to show significant differences in tendencies to approach and avoid the stimuli.

However, the fact that the pull latencies alone were significant and demonstrated the preference for blue that was seen on the AMP suggests that a modified version of this task could be used in future research like this. It appears to be sensitive enough to detect approach tendencies toward different stimuli. However, perhaps because color is not sufficiently negative enough to produce an automatic avoidance response, the push trials may not be necessary. The approach avoid task was not developed to test what this study intended to measure, but approach or avoid tendencies toward positive or negative stimuli. In this study, it was intended to measure attraction and desire to stimuli that are neutral, like color. The AMP directions asked participants to judge the stimuli on

"aesthetic pleasantness," which is more similar to attraction and desire, though less intense. However, it is unclear whether the approach avoid task could be used to determine whether something is not only good, but also desirable, as it has not been used in such a way in the past. Even though it can accurately distinguish between a positive or negative stimulus, it might not be indicative of desire to have or reject it. This study was intended to measure passion and desire toward a woman, and although overall goodness may be correlated to passion, it is not the same dimension. In order to ensure that the measures are accurately capturing desire, they should be correlated to explicit measures of such.

The present study did not provide support for my hypotheses. Several weaknesses associated with data collection could explain why. These also provide future directions for this line of research. For one, there were only 21 males. Since the effect of red, according to previous studies should have only affected them, the small sample may not have had enough power to show this result. Both measures in the study had very small effect sizes, and so a much larger sample may have been required for adequate power to detect these effects. Prior research demonstrated a significant influence of red with similarly low eta squared values, like 0.11 when comparing red to gray and 0.08 for red versus white when the analysis included women (Elliot & Niesta, 2008). However, the study also reported some large Cohen's *d* measures for the effect of the color red as 1.11 compared to white, 0.73 compared to green and 0.86 compared to blue.

In addition, sexual orientation may have been an issue. Theoretically, red should only enhance attraction toward a gender one is already attracted to. Not excluding

homosexual males may have also reduced power and prevented us from seeing results. Since homosexual men are not attracted to women, peripheral cues of attractiveness such as the color red might not affect their judgments. Though sexual orientation was measured in the study, the data for that question was corrupted and lost and was not available for analysis, so I cannot know if this was the case for this study. However, though the exact percentage is not available, American University is ranked by *The Advocate* as one of the top 20 campuses for LGBT students, which suggests the population sampled may have a high percentage of homosexual males (Windmeyer, 2006). Research has shown some differences in attractiveness judgments based on gender and sexual orientation, though gender differences appear more pronounced (Jankowiak, Hill & Donovan, 1992). Future research examining the effect of red should assess sexual orientation.

Another possible moderating variable, which I did not analyze, is relationship status. Red may only serve as a cue for attractiveness if one is single and looking for a mate. Research has shown that romantically involved people with high self regulation tend to exhibit less interest in attractive alternatives than those not in a relationship (Ritter, Karremans, & van Schie, 2010). Another study of nonconscious behavioral mimicry supports this idea with the finding that people in a romantic relationship mimic attractive members of the opposite sex to a lesser extent than people not committed (Karremans & Verwijmeren, 2008). If red only cues attractiveness when one is looking for a mate, this may provide support for a biological basis for the effect. It may serve as a

way to indicate reproductive fitness that we are hard wired to perceive. Unfortunately, I did not assess relationship status in the current study.

The large amount of undifferentiated, constant responses on the AMP, especially when the AMP came second, suggests that participants were fatigued by the task. Though dropping these participants from analyses did not affect the results of the study, it is still an issue that should be addressed in subsequent research, since the results with participants that were all engaged in the task could have been different. Since both of these measures involve using many repetitive trials in order to maximize reliability, future studies should use one or the other to keep participants engaged.

Finally, research thus far does not appear to address whether or not women of other races are perceived as more attractive when wearing red. In the current study, I used only pictures of Caucasian women and prior studies did not report the race of the women used in their target photos. Future research should address this question using both implicit and explicit measures.

Aside from these methodological issues, the preference for blue did not allow me to see an effect of red as shown in previous studies. Studies on color preference alone have shown that preference for the color blue compared to other colors is common (McManus, Jones & Cottrell, 1981). Despite this, research on the effect of the color red had found that it enhanced judgments of attractiveness even when compared to blue. Using another color or several colors as a comparison may have allowed me to replicate these findings by reducing the possibility that color preference would obscure the effect of red. One possibility for why this study was affected by the preference for blue and

prior studies had not might have to do with the editing of the pictures. In previous studies, the women being rated were wearing the different color shirts. In my study, shirt colors were digitally altered which may have made the color more salient when doing automatic ratings of attractiveness. In other words, the shirts may have appeared obviously altered and that could have drawn the eye in a way that may have made shirt ratings more heavily based on color than they would be with an unaltered photo.

The present study did not support the hypothesis that the effect of the color red shown in previous research occurs automatically. However, the study did provide support for the idea that automatic processes are involved in judgments of visual stimuli by showing that the AMP, which is an implicit measure, accurately captures self reported color preference. The study demonstrated the ability of the AMP to detect these implicit judgments of visual stimuli and suggests that perhaps, the approach-avoid task is not adequate for this type of research, though a modified version of it might be. Given the richness of this topic, further research should explore whether the color red affects automatic judgments of attractiveness using more realistic-looking stimuli and different populations.

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