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The (Absent) Romantic Red Effect:

Red products do not influence perceptions of attractiveness

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Abstract

Previous research suggests red can enhance perceptions of attractiveness in the heterosexual affiliation domain. We sought to establish whether the romantic red effect had a positive influence on impression formation of wearers of red technology. Experiment 1 (N = 273) was a cross-cultural replication of a Taiwanese experiment. The original experiment suggested males rate a female holding a red laptop higher on sex-related perception variables. We found no evidence for a red effect in our Dutch sample. Experiment 2 (N = 279) tested the romantic red effect on females viewing males. A male pictured with a green watch was rated as significantly higher on sex appeal than with blue or black. Again, we observed no evidence for a red effect. Our results support a small body of null findings accumulated from failed romantic red replications. We discuss implications of our results. We suggest future researchers should focus on hypothesis-testing the red effect to combat the null findings.

Red Products do not Influence Perceptions of Attractiveness

"Roxanne you don't have to put on the red light (…), you don't have to sell your body to the night (…), walk the streets for money" (Sumner, 1990, track 3). These renowned song lyrics refer to the act of advertising sexual services via means of a red light. Generating a "red-coloured atmosphere" (Chapuis, 2016, p. 7), a red-light district is an urban area where sex-orientated businesses cluster (Ashworth, White & Winchester, 1988). Although sex work is largely considered an unconventional source of income (Hubbard & Whowell, 2008), associations between red and sex extend beyond the unusual and are commonplace in mainstream culture; as demonstrated by the prevalence of red during Valentine's Day, in cosmetics (Elliot & Maier, 2012), lingerie (Luciani & Deal, 2009), and provocative dresses (Gwin, 2002). Colour associations can be context-dependent (Elliot & Maier, 2012). They may influence how we view people; at formal conferences, males wearing red ties are more likely to be perceived as credible (Bashir & Rule, 2014). At exclusive media events, people granted access to a cordoned-off red carpet are more likely to be "bestowed various forms of status – including prestige, recognition, and respect" (Swiatek, 2014, p. 4). On romantic dates, males are more likely to perceive their female counterpart as sexually desirable if she arrived wearing red (Elliot & Niesta, 2008). In these examples, the presence of red may enhance impression formation. A coloured stimulus can evoke pre-conceived associations in the perceiver, which are then transferred to the wearer (Elliot & Maier, 2012). Some people are aware of colour influences; for example, the red "power tie" (Kramer, 2016, p. 2). Often seen on politicians and public figures (Bashir & Rule, 2014), some may chose to purchase a red tie because they heard it conveys a message of pre-eminence (Kramer, 2016). Another example is wearing red clothing to signal sexual interest. Females anticipating meeting an attractive male (Elliot, Greitemeyer, & Pazda, 2013) and females seeking casual sex (Elliot & Pazda, 2012) are more likely to wear red. In these instances, associations with red may have

motivated consumer choices. If so, they could have implications for the marketing of red-coloured products.

C**olour-in-Context**

To effectively study the influence of red on consumer choice, we must understand how colour can carry different meanings in different contexts. Elliot and Maier (2012) devised the seminal Colour-in-Context Theory. It provides an explanatory framework for how colour affects our psychological functioning; our affect (feelings and emotions), cognition (mental processing and perceptions), and behaviour (approach or avoid motivation). The theory consists of six core premises. First, colour carries meaning. Beyond simple aesthetics, colour is a visual stimulus that can convey meaningful information. For example, the colour red is used on road signs to convey a universal message of warning. Second, colour can influence our evaluative processes and determine whether we adopt an avoid (hostile) or approach (hospitable) motivation to a stimulus. For instance, during academic tasks, students are more likely to adopt an avoid motivation to red stimuli as societal learning has taught them it represents failure (Elliot, Maier, Binser, Friedman, & Pekrun, 2009). Third, colour meanings are automatic and occur outside of our conscious awareness. Students may not be consciously aware the presence of red elicited an avoid motivation and subsequently distracted them from their task (Elliot et al., 2009). Fourth, colour meanings, and their subsequent responses, have two sources of origin: biological (evolved) and learned (classical conditioning). The sources are not mutually exclusive. For example, both black and red act as a mediator in males' perceptions of female attractiveness: black represents fashionableness (societal learning) and red represents sexual receptivity (biological basis and societal learning) (Pazda, Elliot, & Greitemeyer, 2014). Fifth, relations between colour perception, affect, cognition, and behaviour are reciprocal; psychological state can influence colour interpretation. For instance, a time-pressured academic task may

induce a stressed affective state in a student; which renders them more susceptible to perceiving red as threatening (Lichtenfeld, Elliot, Maier, & Pekrun, 2012). Last, colour meanings are determined by their contextual surroundings. Visual features, such as texture, motion, and shape, can elicit different approach motivations. An individual with an aversion to blood may avoid red-coloured liquids, but approach a gift encased in red-coloured paper. Colour-in-Context Theory provides a framework for social psychologists to base research around and will be referenced throughout this thesis.

Red as a Special Colour: the Achievement Domain

Colours vary in hue (what is commonly referred to as 'colour'), chroma (vividness or intensity), and lightness (white-to-black ratio). Achromatic colours lack hue (white, grey, and black), whilst chromatic colours vary in hue (red, blue, green, yellow, etc) (Elliot & Maier, 2012). Elliot and Maier (2012) describe red as a "special colour" (p. 105). Red is the colour that has most consistently had a significant effect on context-dependent avoid and approach motivation. We will first address achievement settings (avoid motivation) then affiliation settings (approach motivation).

In achievement settings, where competency is evaluated, the presence of red may elicit avoid motivation. The universal teaching practice of using red to indicate academic failure may have conditioned people to seek to avoid it (Elliot & Maier, 2012). During IQ testing, the presence of red can trigger an anxious affective state, as measured by increased heart rate (Elliot et al., 2011). Presenting red before or during tasks can impair intellectual (Elliot et al., 2009; Elliot, Maier, Moller, Friedman, & Meinhardt, 2007) and physical strength performance (Elliot & Aarts, 2011). It appears that attempts to avoid red distracts individuals from their tasks. Further, researchers have attempted to establish the influence of wearing red on impression formation (Bashir & Rule, 2014; Maier et al., 2013).

Within employment settings, red may negatively influence impression formation; recruiters are more likely to perceive applicants pictured wearing a red tie as less intelligent and having less earning and leadership potential (Maier et al., 2013). Other research suggests a red tie has no influence on impression formation (Kramer, 2016). Contrarily, information provided by a male wearing a red tie is more likely to be considered accurate (Bashir & Rule, 2014). The influence of wearing red on impression formation in the achievement domain is inconsistent. It appears that wearing a red tie to a job interview may prompt employers to avoid you, but wearing one when giving an informative speech may render your message more persuasive. The positive influence of red is more consistent in the affiliation domain.

Red as a Special Colour: the Affiliation Domain

As mentioned in the fourth premise of Colour-in-Context, colour associations can have biological and/or societal origins. A combination is likely to be responsible for positive red associations in the affiliation domain (Elliot & Maier, 2012). We will cover biological explanations, then societal.

Research on nonhuman primates can help us understand primitive red associations as we can readily observe the role of red in mating behaviour (Elliot & Maier, 2012). In male primates, high testosterone levels (Beehner, Bergman, Cheney, Seyfarth, & Whitten, 2006) and male-on-male competition produces a visible reddening of the skin (Andersson, 1994). Red skin colouration informs female primates a male is of high status (Khan, Levine, Dobson, & Kralik, 2011). Female primates prioritize mating with high-status males as it increases the likelihood she will give birth to pathogen-resistant offspring (Waitt et al., 2003). Similar skin-reddening processes are observable in male humans; high testosterone levels increase blood flow to visible areas of the skin (Blas, Perez-Rodriguez, Bortolotti, Vinuela, & Marchant, 2006) and physically-fit human males have a redder skin tone (Changizi, 2010).

How do evolutionary-based adaptations operate in modern Western civilizations? Elliot and Maier (2012) believe high-achieving males that compete for pay rises and job promotions are subject to testosterone-induced skin changes. Selecting a high status mate is important to human females; universally, they consider high social status to be a necessary requirement of a potential romantic partner (Li, Bailey, Kenrick & Linsenmeir, 2002) and females direct more attention towards males with high social status (DeWall & Maner, 2008). For females viewing males, red informs her he is of high status. Although serving the same purpose, to elicit approach motivation, the presence of red has different meanings for males viewing females.

Nonhuman primate research suggests the presence of red on females is indicative of sexual receptivity (Stockley & Bro-Jørgensen, 2011). In the periovulatory phase, female primates develop a notably redder genitalia (Zinner, Nunn, van Schaik, & Kappeler, 2004) and male primates pay more attention to those that do (Waitt, Gerald, Little, & Kraiselburd, 2006). Ovulation is not advertised in such an obvious manner in human females, though similar processes occur; females report an increase in sexual arousal nearing ovulation (Bullivant et al., 2004), which increases blood flow to the skin (Katchadourian, 1984). Roberts et al. (2004) found that ovulating females are rated as more attractive. Males find females wearing red as more attractive via mediation of sexually receptivity (Pazda, Elliot, & Greitemeyer, 2012; Pazda et al., 2014). Schwarz and Singer (2013) found that red was only influential in increasing males' attraction to young, but not menopausal, females; further supporting a reproductive-driven basis. Both males and females appear to have an innate red-detecting apparatus. This apparatus may be complemented by societal learning.

Males are red-light districts' primary clients (Hubbard & Whowell, 2008) so they are exposed to arguably the most tenacious association between red and sex. Males report red to be the most attractive colour of lingerie and sales are higher leading up to red-affiliated

Valentine's Day (Luciani & Deal, 2009). Red is often linked to words that express power and dominance (Schaie, 1961), such as "fiery tempered" (Little & Hill, 2007, p. 166). By only allowing celebrities and dignitaries access to a red carpet, society reinforces cognitive links between red and high status (Elliot et al., 2010; Swiatek, 2014). For both males and females, society may reinforce biologically-predisposed red associations.

Within the heterosexual affiliation domain, red serves the purpose of motivating one gender to approach the other. Social psychologists name this the "romantic red effect" (Elliot & Maier, 2012, p. 94). It is the romantic red effect's elicitation of approach motivation that may be of interest to marketers, and which forms the premise of the current research.

Romantic Red: Empirical Evidence for Females Viewing Males

Arguably the most extensive research into the romantic red effect and females viewing males was conducted by Elliot et al. (2010). Elliot et al. (2010) either manipulated the background colour of a photo of a male, or manipulated the colour of a shirt worn by a male in a photo. Across seven experiments, they found that red, as opposed to white, grey, green, and blue, enhanced perceptions of attractiveness and sexual attractiveness. They found that red was only influential in females viewing males, and not females viewing females, suggesting a heterosexual basis. Even when measuring other desirable personality traits, such as likeability, agreeableness, and extraversion, significant results were only observed for sex-related measures. Elliot et al. (2010) also found that status was a mediator between red, attractiveness, and sexual desirability; red enhanced attractiveness by enhancing status, and red enhanced sexual desirability by enhancing status and attractiveness.

The results from Elliot et al.'s (2010) research are impressive. Across a multitude of control colours, red was the only colour to significantly increase sex-related perceptions. Red appears to act as an aphrodisiac for females viewing males because it conveys a message of

high status. Nonetheless, few studies have been conducted on females viewing males. The majority of research has focused on males viewing females (Elliot & Maier, 2012)

Romantic Red: Empirical Evidence for Males Viewing Females

Elliot and Niesta (2008) tested the romantic red effect on males viewing females. They found that a female pictured against a red background, as opposed to white, grey, and green, was rated as significantly higher on perceived attractiveness and sexual desirability. Males viewing females in a red shirt, relative to blue, rated her as significantly more attractive and sexually desirable and were more likely to ask her out on a date. Other desirable personality traits, such as kindness and intelligence, were not influenced by red. These results, again, emphasize the sexual nature of the romantic red effect. The results were impressively consistent; none of the control colours were shown to significantly influence the perception measures. Elliot and Niesta (2008) used hypothetical scenarios to measure the influence of red. Their results have been supported, however, by research on the elicitation of physical approach motivation (Guéguen & Jacob, 2012, Guéguen & Jacob, 2014; Meier, D'Agostino, Elliot, Maier & Wilkowski, 2012; Niesta Kayser, Elliot, & Feltman, 2010; Schwarz & Singer, 2013).

Niesta Kayser et al. (2010) found that males conversing with females wearing red sat closer to her and asked more intimate questions. Niesta Kayser et al.'s (2010) findings are supported by evidence that suggests males walk faster to meet a female pictured wearing red in a romantic context (Meier et al., 2012). These findings also extend to the field; Guéguen and Jacob (2012) found that male customers, but not female, tipped female waitresses wearing red lipstick more. Male customers, but not female, tipped female waitresses wearing red more (Guéguen & Jacob, 2014). These results support the notion that red elicits approach motivation in males viewing females. However, not all research into the romantic red effect is

supportive (Lynn, Giebelhausen, Garcia, & Patumanon, 2016; Peperkoorn, Roberts & Pollet, 2016).

Null Findings, Replications, and Cultural Robustness

Red may not be the only colour to influence perceived attractiveness (Roberts et al., 2010; Pazda et al., 2014). Roberts et al. (2010) found that red and black, relative to green, white, and yellow, had an equivalent influence on enhancing males' perceptions of female attractiveness. Pazda et al. (2014) concluded that black can enhance perceptions of attractiveness via mediation of fashionableness. These findings suggest red is not unique in eliciting approach motivation. Some findings do not find evidence for a red effect at all (Lynn et al., 2016; Peperkoorn et al., 2016).

Across three experiments, including a replication of supportive research by Pazda et al. (2012, Study 1a), Peperkoorn et al. (2016) found no influence of red or black on approach motivation in males viewing females. Also attempting a replication, Lynn et al. (2016) predicted to reproduce Guéguen and Jacob's (2012) findings. Lynn et al. (2016) found that female waitresses wearing red, relative to white and black, received less tips from males. These results were in contrast to the original findings (Guéguen & Jacob, 2012). It could be argued that Lynn et al.'s (2016) findings would be more influential if they had conducted a close replication.

A close replication is one that is designed to have a method and procedure that is as similar as possible to the original (Brandt et al., 2014). In the case of Lynn et al. (2016), the original experiment (Guéguen & Jacob, 2012) was conducted in the field, with uninformed consumers acting as the participants. In contrast, Lynn et al. (2016) used a hypothetical, online method. Here, Lynn et al.'s (2016) replication may not provide strong evidence against the original theory as differences in findings could be attributed to methodological

differences. Close replications are valuable to psychological research as significant findings can support theories and null findings can inspire psychologists to adopt new approaches to discovery (Brandt et al., 2014). Additionally, demonstrating cultural robustness can provide evidence for a theory (Finifter, 1977).

Most of the aforementioned research was conducted in Western cultures. Some cross-cultural romantic red research, however, has been conducted (Elliot et al., 2010; Elliot, Tracy, Pazda, & Beall, 2013; Lin, 2014). Elliot et al., (2013) tested the romantic red effect in Burkina Faso, West Africa, and found supportive evidence. Elliot et al. (2010, Experiment 4) found evidence of the romantic red effect in female Chinese participants. Most notably, Lin (2014) conducted research on the romantic red effect in East Asia (Taiwan). Lin's (2014) experiments are particularly interesting as they are the first to use an electronic device as the colour-manipulating stimulus. A female pictured with either a black, blue, red, or silver laptop was shown to 80 male and 80 female Taiwanese participants. Lin (2014) found that males, but not females, rated the female with the red laptop higher on perceived attractiveness, sex appeal, and sexual desirability. Lin (2014) also measured perceived assertiveness and healthiness, but found no differences for laptop colour. These results provide support for cultural robustness of the romantic red effect. Lin (2014) concluded that his results have implications for the marketing of red electronic devices.

The current market is heavily populated with red products (Lin, 2014). People are demanding more colour choices, even for products that usually have limited options (Labrecque & Milne, 2012). Computer manufacturing giants Dell, Hewlett-Packard, and Lenovo offer laptops in red (Laptops, n.d.). Wearable technology is available in red; such as the best-selling Beats headphones (Potuck, 2017). Technology powerhouse Apple offer their new Apple Watch in red (Griffin, 2017). Visible on the upper body and worn externally, wearable technology is likely noticeable by others. Can red associations enhance impression

formation of those that wear red wearable technology? Physical attractiveness and high status are desirable qualities in mate preferences (Buss & Barnes, 1986), so evidence that red wearable stimuli can enhance them would be of interest to marketers.

Research Overview

As suggested by Peperkoorn et al. (2016), social psychologists should prioritize hypothesis-testing the romantic red effect over exploration. It is concerning that Peperkoorn et al. (2016, Experiment 3) conducted a close replication of supportive research (Pazda et al., 2012, Study 1a) and found no effect. Because Lin's (2014) results have implications for the cross-cultural marketing of red products, it is important to test whether the findings are consistent. The current research consisted of two experiments. In Experiment 1, we conducted a close replication of Lin (2014, Experiment 1) in the West (the Netherlands). European and East Asian cultures vary on a multitude of factors (Nisbett & Masuda, 2003), so a successful replication attempt would provide evidence for an evolutionary origin.

Research on females viewing males is limited, so Elliot et al. (2010) has received minimal support. Experiment 2 sought to clarify the gender-robust influence of red, and the mediating effect of perceived status, by researching females viewing males. Previous romantic red researchers have used easily-visible colour manipulation stimuli, such as a shirt in a cropped photo (Elliot et al., 2010; Elliot & Niesta, 2008). Experiment 2 sought to establish the influence of minimal colour manipulation on person perception. If minimal colour cues influence person perception in the affiliation domain, it could suggest we are biologically-wired to detect even small instances of red on the opposite sex; further demonstrating an evolutionary basis. To ensure the results were also applicable for the marketing of red products, a watch was used as the colour manipulator. We believe this was the first romantic red research to use a watch as the colour stimulus.

Experiments 1 and 2 contributed to the current body of research by hypothesis-testing the romantic red effect and checking for cultural robustness, but also by providing insight into a new field (electronic products).

We hypothesized:

1) Males rate a female pictured with a red laptop as higher on attractiveness, sex appeal, and sexual desirability, than a female pictured with a black, blue, or silver laptop.
2) Males do not rate a female pictured with a red laptop as more assertive or healthy than the other laptop colours.
3) Females rate a male pictured with a red watch as higher on attractiveness, sex appeal, and sexual desirability, than a male pictured with a black, blue, or green watch.
4) Females do not rate a male pictured with a red watch as more assertive or healthy than the other watch colours.
5) Females rate a male pictured with a red watch as having higher status than a male pictured with the other watch colours.

Experiment 1

A male, Dutch student sample was used to test Hypotheses 1 and 2. Colour was manipulated by showing participants a photo of a female holding either a black, blue, red, or silver laptop. Approach motivation was measured by males' ratings of the female's perceived: attractiveness, sex appeal, sexual desirability, assertiveness, and healthiness.

Method

Participants. Close replications must yield sufficient statistical power (Brandt et al., 2014). One method to ensure this is to multiply the original sample size by 2.5 (Simonsohn, 2015). Lin (2014) recruited 80 participants. Two hundred and seventy-three male participants were recruited for the current experiment. Their mean age was 22.3 years (*SD* = 4.31 years, range = 16-47 years) and 86.4% of participants reported to have the Dutch nationality only (others included German (2.2%) and American (1.5%)). Of the sample, 91.2% were heterosexual, 4.8% homosexual, and 2.9% bisexual. For Experiments 1 and 2, participants were informed they would be entered into a cinema ticket raffle if they included their email address on the informed consent form (see Appendix A). Twenty €15 tickets were available and winners were selected randomly (10 from each experiment).

Design, Procedure, and Materials. Experiment 1 received ethics approval from the Ethics Review Board of Leiden University. Participants were randomly assigned to one of four between-groups conditions: black (*n* = 68), blue (*n* = 68), red (*n* = 69), or silver (*n* = 68). For Experiments 1 and 2, we (two researchers) were blind to the conditions participants received, but were aware of the experimental objectives. All participants were unaware of the experimental hypotheses.

We recruited participants from within three campus buildings of Leiden University and one campus building of Hogeschool Leiden. Data was collected between the hours of

11am and 5pm, on weekdays, between late February and mid-March 2017. We never collected data from the same building at the same time. We carried pre-packaged envelopes; each envelope contained an informed consent form and a questionnaire.

The questionnaire was created on Microsoft Word. Two pages of white A4 paper were printed double-sided (four sides) and stapled. The first side collected demographics: Gender (Male, Female, Other), Age, Nationality (Dutch, Other), Student Status (Yes, No), and Sexual Orientation (Heterosexual, Homosexual, Bisexual, Prefer to Not Say, Other). When answering "Age" or selecting "Other," participants had space to write qualitatively. The second side was left blank. The third side showed a colour photo of a female with either a black, blue, red, or silver laptop (see Figure 1). The photos used were the same ones used by Lin (2014) and were not altered. Lin (2014) ran a pilot study on photos of 10 females and 10 laptops. He asked participants to rate them on a 10-point Likert scale (1 = high unattractiveness, 10 = high attractiveness). He selected the female and laptop that received the most average mean rating (female = 5.2, laptop = 5.1). Using unusually un/attractive stimuli can lead to data skew (floor/ceiling effects). Chances of producing skewed data can be reduced by using stimuli pre-rated as average. Beneath the photo were five rows of questions (see Measures). The fourth side asked "what colour was the laptop?" and participants answered qualitatively. Two questionnaires were created for each colour condition: one in Dutch and one in English. Two hundred and forty (60 of each colour condition) were printed in Dutch. Forty (10 of each colour condition) were printed in English. All questionnaires were printed from the same printer; a Canon C5250i.

Figure 1. Stimuli used in Experiment 1. Participants were shown a photo of a female carrying either a black (top left), blue (top right), red (bottom left), or silver (bottom right) laptop.

We approached males and asked if they could participate in an experiment on person perception. After signing an informed consent form, participants were handed a questionnaire and asked to answer based on their first impression. Participants sitting in proximity were asked to shield their questionnaires. Here, the procedure of the current experiment differed from the original (Lin, 2014). Lin (2014) split 80 participants into four groups of 20 and moved each group to a separate room. Each group was assigned one colour condition. Participants filled the questionnaire out individually, or in small groups or two to three. For the current experiments (1 and 2), participants completed the questionnaire in the same place they were in when approached. To ensure anonymity and confidentiality, we distanced

ourselves whilst they answered. Participants were not given a time limit for completion, but most finished under five minutes. Once finished, each questionnaire was placed into an individual envelope and sealed. Informed consent forms were placed into a separate file folder. We finished by thanking and debriefing (see Appendix B) participants.

Measures. The questions and Likert scale format used in the current experiment were the same as those used by Lin (2014). The questions were presented in the same order and were not counterbalanced. One item measured perceived attractiveness: "how much does the woman in the photo attract you?" Two items measured perceived sexual attraction: "how strong is her sex appeal?" and "how strong is your desire to engage in sexual activity with her?" Perceived assertiveness was measured on one item: "how assertive do you find her?", as was perceived healthiness: "how healthy do you think she is?" Participants answered on 5-point Likert scales, with five labels (1= not at all, 2 = not much, 3 = neutral, 4 = somewhat, 5 = very much).

Planned Statistical Analyses

Preliminary Screening. IBM SPSS Statistics 23 and JASP 8.0.1.1 were used to conduct data analysis. In SPSS, a variable called "Almost Correct" was created. Participants were organized according to the answers they gave for the "what colour was the laptop?" question. If a participant included the colour name of their corresponding colour condition in their answer, they were marked as "yes." For example, if a participant was allocated a blue condition and wrote "dark blue," they would be marked as "yes." If the same participant wrote "grey-black," they would be marked as "no." We considered those marked "no" as either colour-blind or not paying attention during the questionnaire. The variable was created to exclude participants marked as "no." This filtering process will be referred to as the Almost Correct Filter (AC Filter).

Planned Analysis. Lin (2014) performed a one-way between-groups analysis of variance (ANOVA) on each dependent variable, with laptop colour as the independent variable. When significant results were found, he ran Tukey HSD post-hoc tests to observe differences between colours. The current experiments (1 and 2) would use the same analysis as Lin (2014), as well as conducting three additional one-way ANOVAs on each dependent variable, on various forms of the dataset:

1) an ANOVA on the entire dataset, with no participants filtered out (same as Lin, 2014) (N = 273)

2) an ANOVA on the dataset excluding the sexual orientations: Homosexual, Prefer to Not Say, and Other (N = 257). This filtering process will be referred to as the Sexual Orientation Filter (SO Filter)

3) an ANOVA on all sexual orientations, but using the AC Filter (N = 179)

4) an ANOVA on the dataset using the SO Filter and the AC Filter (N = 155)

A Levene's test for equality of group variances was produced alongside each ANOVA. When the assumption of homogeneity of variances was violated (as indicated by $p < .05$), an additional, non-parametric test was ran: the Kruskal-Wallis H (K-W) test. Finally, a one-way Bayesian ANOVA was ran on each dependent variable, for the entire dataset. Bayesian ANOVAs are more informative than lone Null Hypothesis Significance Testing. Bayesian ANOVAs quantify the support for one model (e.g. null hypothesis), over another (e.g. alternative hypothesis), regardless if they are significant (Pullenayegum, Guo, & Hopkins, 2012).

To support Hypothesis 1, significant differences needed to be observed between the red laptop and the three sex-related variables. As the romantic red effect may be limited to heterosexual affiliation (Kirsch, Kayser, & Krahé, 2015) and as colour-blind and lacking-

attention participants may be less susceptible to colour influence, we predicted to observe slightly higher average ratings on the sex-related variables in the red condition when the SO and AC Filters were used.

Assumptions. Assumption checks were conducted on the entire dataset, with no participants filtered out. Standardized residuals, Leverage, and Cook's Distance outputs were checked. Although some outliers were observed (see Figures 2 and 4) none were considered influential (as determined by Cook's $D_i > 1$). No outliers were removed. The Kolmogorov-Smirnov test of normality was conducted. It informed us that all independent and dependent variables had non-normal distributions ($p < .05$). However, the central limit theorem, which is applicable for large sample sizes ($N > 30$), ensured that test statistics produced in our analyses were robust against deviations from normality.

Results

Attractiveness. Four one-way ANOVAs were conducted to assess the influence of laptop colour on attractiveness. Non-significant results were found for: the entire dataset, the dataset with the SO Filter, with the AC Filter, and with both Filters (respectively: $F(3, 269) = 1.02$, $p = .382$, $F(3, 253) = 0.91$, $p = .437$, $F(3, 174) = 1.40$, $p = .245$, $F(3, 165) = 1.28$, $p = .282$).

Sex Appeal. Four one-way ANOVAs and two subsequent K-W tests were conducted with sex appeal as the dependent variable. As shown in Table 1, all were non-significant.

Table 1

For Experiment 1, Showing One-Way ANOVA and Kruskal-Wallis H Results for Sex Appeal, on Four Forms of the Dataset

	One-Way ANOVA				Kruskal-Wallis H		
Dataset	df_b	df_w	F	p	df_b	χ^2	p
Entire	3	269	1.60	.189	3	5.90	.117
SO Filter	3	253	1.34	.261	3	5.13	.163
AC Filter	3	174	1.18	.319	3	-	-
Both Filters	3	165	0.98	.405	3	-	-

Note: SO Filter = Sexual Orientation Filter. AC = Almost Correct Filter. Additional Kruskal-Wallis H tests were conducted when a significant Levene's test (indicating unequal variances) was produced alongside an ANOVA.

Sexual Desirability. As shown in Table 2, the four one-way ANOVAs and two subsequent K-W tests that were conducted on sexual desirability were non-significant.

Table 2

For Experiment 1, Showing One-Way ANOVA and Kruskal-Wallis H Results for Sexual Desirability, on Four Forms of the Dataset

	One-Way ANOVA				Kruskal-Wallis H		
Dataset	df_b	df_w	F	p	df_b	χ^2	p
Entire	3	269	1.74	.159	3	2.91	.406
SO Filter	3	253	2.14	.096	3	3.81	.282
AC Filter	3	174	1.02	.384	3	-	-
Both Filters	3	165	1.22	.306	3	-	-

Note: SO Filter = Sexual Orientation Filter. AC = Almost Correct Filter. Additional Kruskal-Wallis H tests were conducted when a significant Levene's test (indicating unequal variances) was produced alongside an ANOVA.

Assertiveness. Four one-way ANOVAs were conducted with assertiveness as dependent variables. Non-significant results were found for: the entire dataset, the dataset with the SO Filter, with the AC Filter, and with both Filters (respectively: $F(3, 269) = 0.36$, $p = .780$, $F(3, 253) = 0.38$, $p = .769$, $F(3, 174) = 0.22$, $p = .880$, $F(3, 165) = 0.21$, $p = .893$).

Healthiness. Four one-way ANOVAs were ran with healthiness as the dependent variable. The entire dataset produced a non-significant result, as did the dataset with the SO Filter, with the AC Filter, and both Filters (respectively: $F(3, 269) = 0.37$, $p = .772$, $F(3, 253) = 0.64$, $p = .588$, $F(3, 174) = 1.20$, $p = .311$, $F(3, 165) = 1.07$, $p = .364$).

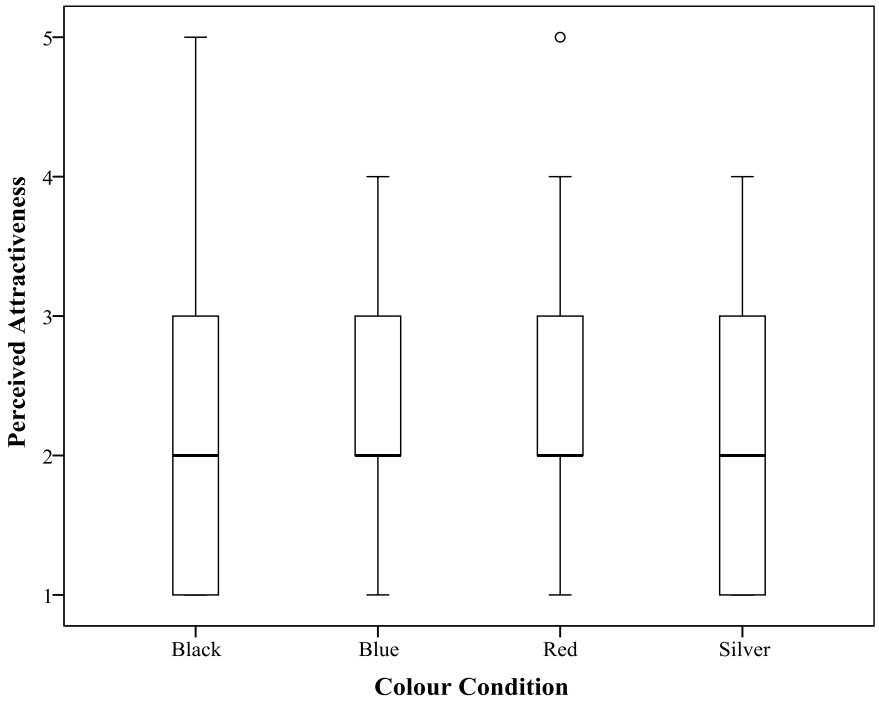

Figure 2. Box plots from Experiment 1 depicting perceived attractiveness as a function of laptop colour. The whiskers beyond the upper and lower quartiles indicate the 1.5 interquartile range (IQR). Outliers are based on 1.5*IQR.

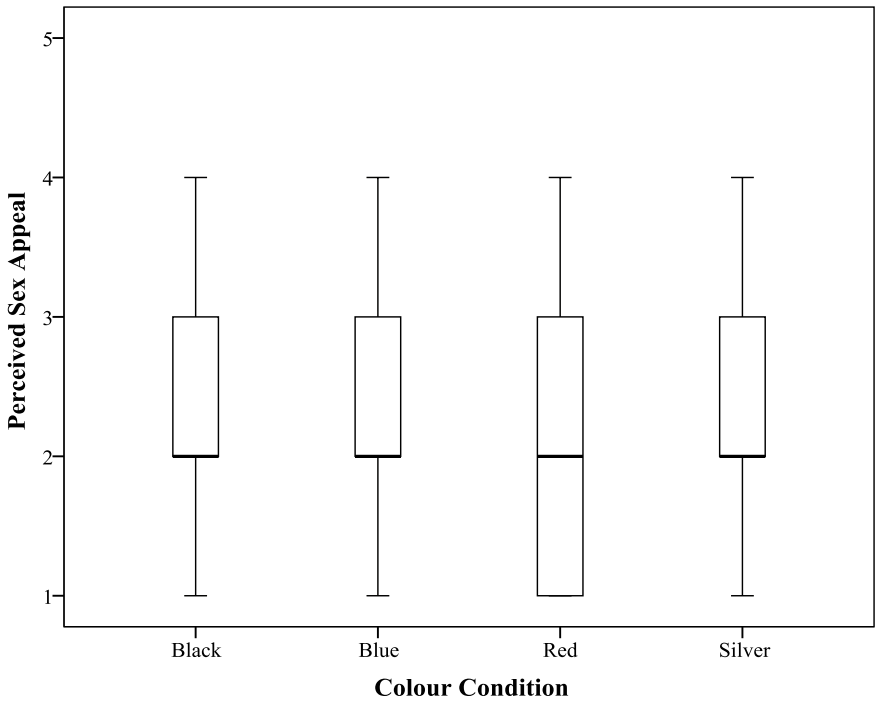

Figure 3. Box plots from Experiment 1 depicting perceived sex appeal as a function of laptop colour. The whiskers indicate the 1.5 IQR.

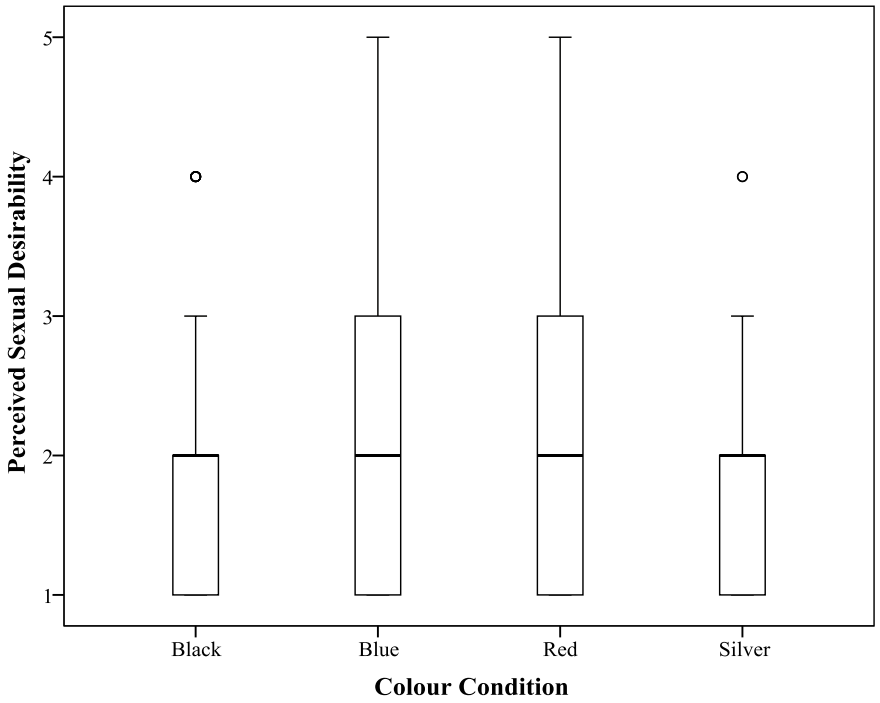

Figure 4. Box plots from Experiment 1 depicting perceived sexual desirability as a function of laptop colour. The whiskers indicate the 1.5 IQR. Outliers are based on 1.5*IQR.

Table 3

For Experiment 1, Showing Results of One-Way Bayesian ANOVAs on the Dependent Variables

Variable	Support For	BF_{10}	Evidence	*More Likely
Attractiveness	Null	0.063	Strong	15.87
Sex Appeal	Null	0.131	Moderate	7.63
Sexual Desirability	Null	0.157	Moderate	6.37
Assertiveness	Null	0.027	Very strong	37.04
Healthiness	Null	0.027	Very strong	37.04

Notes. Support For = which hypothesis (null or alternative) the ANOVA provided support for. BF_{10} = Bayes Factor. Evidence = how much evidence is provided in support of the hypothesis (interpreted according to Jeffrey's (1961) classification categories), ranging from weakest to strongest: No Evidence, Anecdotal, Moderate, Strong, Very Strong, Extreme. *More Likely = times more likely the data occurred under the mentioned hypothesis, as calculated by $1/BF_{10}$.

Discussion

The results from Experiment 1 failed to support Hypothesis 1 and were inconsistent with findings from the original experiment (Lin, 2014, Experiment 1). The results support other null findings (Lynn et al., 2016; Peperkoorn et al., 2016). The original results for assertiveness and healthiness (Lin, 2014) were supported, as were Hypothesis 2, as colour manipulation did not influence perceptions of assertiveness and healthiness.

We predicted that mean ratings of attractiveness, sex appeal, and sexual desirability would be significantly higher in the red condition. However, the female with the red laptop (M = 2.40, SD = 1.08) was not rated significantly higher on attractiveness than with the black (M = 2.20, SD = 1.03), blue (M = 2.35, SD = 0.97), or silver laptop (M = 2.13, SD = 1.05). As shown in Figure 2, all colour conditions scored the same average. Blue and red had an equivalent effect. Considering score distributions, participants in the chromatic conditions were in more agreement than participants in the achromatic conditions. Although 25% of scores were allocated to the lowest option, black also received the highest scores. Black may have elicited approach motivation in some participants.

For sex appeal, there were no significant differences between the red (M = 2.26, SD = 1.05), black (M = 2.20, SD = 0.83), blue (M = 2.50, SD = 0.80), or silver laptops (M = 2.22, SD = 0.97). As shown in Figure 3, on average, all colours had an equivalent effect. Twenty-five percent of scores in the red condition, however, consisted of the lowest possible score. This was contradictory to our predictions as red appeared to be more likely to elicit avoid motivation than the control colours.

For sexual desirability, the red laptop did not score significantly higher (M = 2.13, SD = 1.21) than the black (M = 1.83, SD = 1.00), blue (M = 1.94, SD = 1.02), or silver laptop (M = 1.75, SD = 0.83). As demonstrated in Figure 4, the chromatic colours had an equivalent

effect. The achromatic colours also had the same influence as each other. The chromatic colours received overall higher scores in their IQR, as well as receiving some of the highest possible scores. For sexual desirability, colours with hue were more likely to elicit approach motivation. Results from Experiment 1 suggest that chromatic colours have more of a positive influence on person perception than achromatic. As people in general prefer chromatic colours, this hue preference can be transferred to an available person and enhance an initial perception (Elliot et al., 2010). Overall, contrary to predictions, red was not shown to have a unique, positive influence on impression formation. We predicted to observe slightly higher mean ratings when individual differences had been filtered out. As Shown in Appendix D1, the dataset using both Filters produced minimally higher means for attractiveness (M_{entire} = 2.40 vs $M_{filters}$ = 2.44), sex appeal (M_{entire} = 2.26 vs $M_{filters}$ = 2.29), and sexual desirability (M_{entire} = 2.13 vs $M_{filters}$ = 2.17), than the entire dataset. These slight increases were not observed for assertiveness and healthiness, thus providing minimal support for our predictions. Regardless, the absence of an effect is further supported by results from the Bayesian ANOVAs.

As demonstrated in Table 3, all results from the Bayesian ANOVAs provided evidence in favour of the null hypothesis. An absence of a colour effect was supported by moderate to strong evidence and it was 6 – 37 times more likely the data occurred under the null hypothesis. These results suggest Experiment 1 was a replication failure and raises uncertainties about the presence of the original effect. Experiment 2 was conducted to provide more insight by either providing evidence for, or against, Experiment 1. We tested the gender-robustness of the red effect by focusing on a female sample. For Experiment 2, we tested the influence of a minimal colour-manipulating stimulus (a watch).

Experiment 2

A female, Dutch student sample were used to test Hypotheses 3, 4, and 5. Colour was manipulated by showing participants a photo of a male and either a black, blue, red, or green watch. Approach motivation was measured by females' ratings of the male's perceived: attractiveness, sex appeal, sexual desirability, assertiveness, healthiness, economic success, education level, and job prestige. Black was included as a control colour as it may elicit approach motivation (Roberts et al., 2010; Pazda et al., 2014). Green and blue have featured as control colours in previous research (Elliot et al., 2010), so their inclusion would allow for non-statistical cross-experiment comparison. Furthermore, green was chosen to replace silver as we wanted to compare red against two other chromatic colours (to ensure any differences were not due to hue preferences).

Pilot Study

For Experiment 2, an average-rated male and watch were required. A pilot study was conducted on a photo of a watch.

Participants, Design, Procedure, and Materials. Seventy-eight participants were recruited. Photos of a watch available in several colours were selected from a website (http://www.lacoste.com/us/lacoste/women/accessories/watches/unisex-lacoste.12.12-red-watch/2010764.html). A unisex watch was selected so perceptions of femininity and masculinity did not influence results. Other than removing the brand logo (using Microsoft Paint), the watches were not altered. Unusual watch colours may bias results, so the pilot was conducted on the black watch only. An online questionnaire was created on Survio.com (https://www.survio.com/survey/d/O5Z4E6U2S8Z5A2F7Y). The link to the questionnaire was shared on social media platforms and participants volunteered to take part.

Measures and Results. Perceived attractiveness was measured with one item: "what do you think of this watch?" Participants answered on a 10-point Likert scale (1 = ugly, 5 = average, 10 = beautiful). Perceived expense was measured with one item: "how expensive do you think this watch is"? Answers were recorded on another 10-point Likert scale (1 = cheap, 5 = average, 10 = expensive). Results for attractiveness (M = 6.12, SD = 1.92) and expense (M = 4.90, SD = 1.75) suggested the watch was suitably average.

Method

Participants. Two hundred and seventy-nine participants were recruited. Two participants did not meet the female gender requirement and were removed from all data analysis. The sample's mean age was 21.2 years (SD = 3.51 years, range = 16-42 years) and 90.3% of participants reported to have the Dutch nationality only (others included German (1.1%) and Italian (1.1%)). Of sexual orientations, 90.3% were heterosexual, 1.1% homosexual, and 7.9% bisexual. Participants were entered into the same raffle as mentioned in Experiment 1.

Design, Procedure, and Materials. Experiment 2 received ethics approval from the Ethics Review Board of Leiden University. Participants were randomly assigned to one of four between-groups conditions: black (n = 67), blue (n =70), red (n = 69), or green (n = 70).

We (the same researchers from Experiment 1) used the same procedure detailed in Experiment 1 to recruit participants for Experiment 2. Data was collected from the same university buildings, from early to mid-March 2017. As before, envelopes were pre-packaged; each contained an informed consent form (Appendix A) and questionnaire. The debriefing form for Experiment 2 was slightly different (Appendix C).

As before, the questionnaire was created on Microsoft Word and consisted of two pages of white A4 paper, printed double-sided and stapled. The first and second sides were

the same as those in Experiment 1. The third side showed a colour photo of a male's face (9.45cm width x 10.45cm height). The male was selected from the Radboud Faces Database. Here, standardized, pre-rated faces are available for psychological research. According to Langner et al. (2010), the male received the following ratings: % Agr.: 100, Int.: 3.62, Cla.: 4.00, Gen.: 4.14 and Val: 3.33. % (% Agr. = percentage of agreement on emotion categorization, Int. = mean intensity rating for the facial expression, Cla. = mean clarity for the facial expression, Gen. = mean genuineness for the facial expression, Val. = mean valence rating for the image). Measured on a 5-point scale, the male received an average attractiveness rating (M = 2.36, SD = 0.53). Moderately attractive and displaying a neutral expression, we considered him suitable for use in Experiment 2. The grey background was removed from the photo (using Microsoft Paint) in case it distracted participants. To the right of the photo of the male, was a photo of either a black, blue, red, or green watch (5.82cm width x 8.28cm height) (see Figure 5). "Imagine this man is wearing this watch. Please answer the following questions" was written below, referring to eight rows of questions (see Measures). The fourth side asked "what colour was the watch?" As before, two questionnaires were created for each colour condition: one in Dutch and one in English. Two hundred and forty (60 of each condition) were printed in Dutch. Forty (10 of each condition) were printed in English. They were printed from the same printer used in Experiment 1; a Canon C5250i.

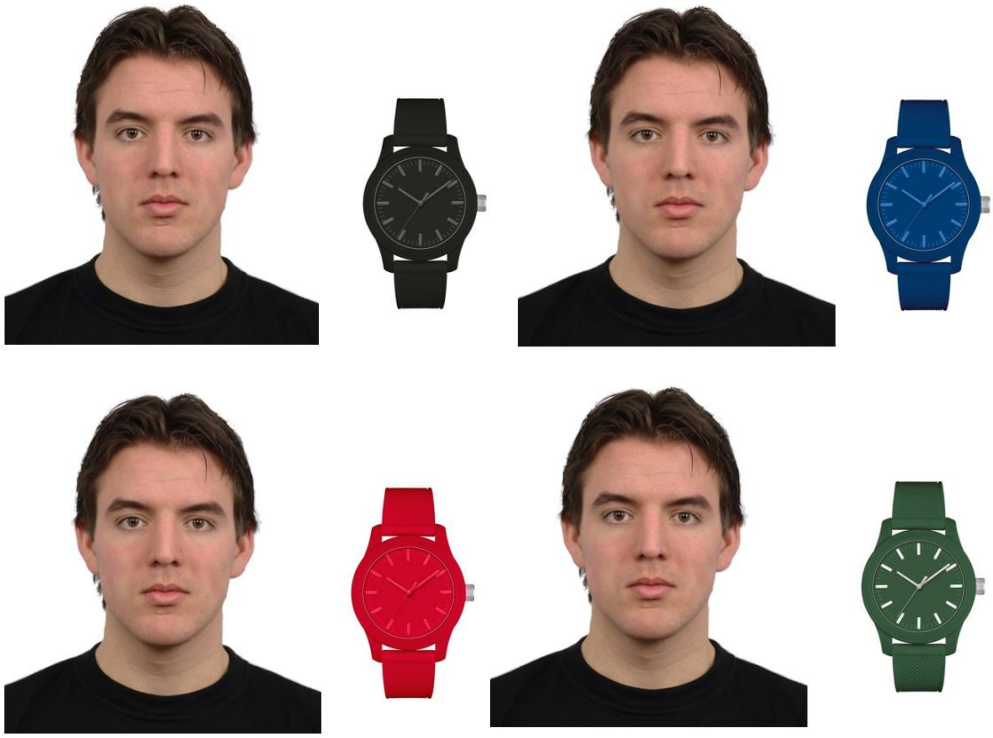

Figure 5. Stimuli used in Experiment 2. Participants were shown a photo of a male and either a black (top left), blue (top right), red (bottom left), or green (bottom right) watch.

Measures. The first five questions were the same as those used in Experiment 1. They were presented in the same order and were not counterbalanced. Experiment 2 included three additional questions. The questions were adapted from research on group stereotypes (Fiske, Cuddy, & Glick, 1999). Using factor analysis, Fiske et al. (1999) concluded that economic success, education level, and job prestige were efficient predictors of status. For use in Experiment 2, the questions were adapted so as to be suitable for referring to an individual, rather than a group. Perceived status was measured on three items: "how economically successful do you think he is?", "how well-educated do you think he is?", and "how prestigious do you think his job is?"

The answering scales for Experiment 2 differed from Experiment 1. Experiment 1 used the same answering scale as Lin (2014) to ensure it was a close replication attempt.

However, 5-point scales may not always be the most accurate method of measurement; Cummins and Galone (2000) suggest 5-point scales produce data that is less reliable and has less validity than scales that surpass 5 points. The limited selection influences participants to select the neutral option (the mid-point) and to avoid the lowest and highest options. Dawes (2012) reports that data collected on 5 and 7-point scales produce a similar mean and results accumulated from both are comparable. By increasing the 5-point scale to 7, we hoped to produce data that was reliable and had high validity, whilst remaining comparable to results from Experiment 1. For Experiment 2, participants answered on a 7-point Likert scale. Cummins and Galone (2000) suggest the labelling of all answer scales can interfere with participants' own judgements about scale distances and influence their answers. For Experiment 2, three answering labels were included (1 = not a lot, 4 = neutral, 7 = a lot).

Planned Statistical Analyses

Preliminary Screening. IBM SPSS Statistics 23 and JASP 8.0.1.1 were used to conduct data analysis. As with Experiment 1, a variable called "Almost Correct" was created in SPSS and all those marked "no" were filtered out of the dataset when it was used. Again, this filtering process will be referred to as the AC Filter.

Planned Analysis. The same statistical analyses used in Experiment 1 were used for Experiment 2. One-way ANOVAs were conducted on: the entire dataset (N = 277), the dataset using the SO Filter (N = 272), using the AC Filter (N = 253), and using both Filters (N = 248). To support Hypothesis 3, mean ratings of perceived attractiveness, sex appeal, and sexual desirability would need to be significantly higher for the red condition. The three status items (economic success, level of education, and job prestige) were averaged to form a composite index (Cronbach's $\alpha = 7.33$). To support Hypothesis 5, a significant difference between red and perceived status needed to be found. Based on previous findings (Elliot et al., 2010), it was predicted that perceived status would be a mediator between the red

condition and perceptions of attraction and sexual attraction. To assess this, mediation would be used. Baron and Kenny (1986) explain how a mediation model seeks to identify the process that underlies a relationship between an independent and dependent variable, via the inclusion of a third variable; the mediator variable. In this instance, red may influence perceptions of status, which, in turn, influence perceptions of attractiveness, sex appeal, and sexual desirability.

Assumptions. Assumption checks were conducted on the entire dataset. Standardized residuals, Leverage, and Cook's Distance outputs were checked. Although some outliers were observed (see Figures 8 and 9) none were considered influential (as determined by Cook's $D_i > 1$), so no outliers were removed. As shown in Figure 8, outliers were more apparent for perceived sexual desirability. The question "how much do you want to engage in sexual activity with him?" can be considered invasive. Participants may have felt uncomfortable answering or, in proximity to others, social desirability influenced them to score low. The Kolmogorov-Smirnov test of normality was conducted. All independent and dependent variables were reported to have non-normal distributions ($p < .05$). However, as with Experiment 1, the central limit theorem ensured that our test statistics were robust against deviations from normality.

Results

Attractiveness. Four one-way ANOVAs and four subsequent K-W tests were conducted to observe the effect of watch colour on attractiveness. As shown in Table 4, all were non-significant.

Table 4

For Experiment 2, Showing One-Way ANOVA and Kruskal-Wallis H Results for Attractiveness, on Four Forms of the Dataset

	One-Way ANOVA				Kruskal-Wallis H		
Dataset	df_b	df_w	F	p	df_b	χ^2	p
Entire	3	273	2.16	.093	3	6.63	.085
SO Filter	3	268	1.93	.125	3	5.78	.123
AC Filter	3	251	1.66	.175	3	4.81	.186
Both Filters	3	244	1.47	.222	3	4.12	.248

Note: SO Filter = Sexual Orientation Filter. AC = Almost Correct Filter. Additional Kruskal-Wallis H tests were conducted when a significant Levene's test (indicating unequal variances) was produced alongside an ANOVA.

Sex Appeal. Four one-way ANOVAs were conducted on sex appeal. The entire dataset produced a significant result $F(3, 272) = 3.49$, $p = .016$, as did the dataset when using the SO Filter $F(3, 267) = 3.33$, $p = .020$. Tukey HSD post-hoc tests revealed the green watch was rated as significantly higher on sex appeal than the black watch ($M_{green} = 2.91$ vs $M_{black} = 2.28$, $p = .028$) and the blue watch ($M_{green} = 2.91$ vs $M_{blue} = 2.33$, $p = .044$). Non-significant results were found for the dataset using the AC Filter $F(3, 250) = 2.37$, $p = .071$, and the dataset using both Filters $F(3, 243) = .2.47$, $p = .063$.

Sexual Desirability. As shown in Table 5, the four one-way ANOVAs and four subsequent K-W tests that were conducted on sexual desirability were non-significant.

Table 5

For Experiment 2, Showing One-Way ANOVA and Kruskal-Wallis H Results for Sexual Desirability, on Four Forms of the Dataset

	One-Way ANOVA				Kruskal-Wallis H		
Dataset	df_b	df_w	F	p	df_b	χ^2	p
Entire	3	294	2.01	.114	3	3.22	.361
SO Filter	3	267	1.98	.117	3	3.22	.361
AC Filter	3	250	2.03	.111	3	2.53	.471
Both Filters	3	243	1.99	.116	3	2.27	.519

Note: SO Filter = Sexual Orientation Filter. AC = Almost Correct Filter. Additional Kruskal-Wallis H tests were conducted when a significant Levene's test (indicating unequal variances) was produced alongside an ANOVA.

Assertiveness. Four one-way ANOVAs produced non-significant results for: the entire dataset, the dataset with the SO Filter, with the AC Filter, and with both Filters (respectively: $F(3, 273) = 1.41$, $p = .240$, $F(3, 268) = 1.41$, $p = .239$, $F(3, 251) = 1.36$, $p = .256$, $F(3, 244) = 1.34$, $p = .261$).

Healthiness. When four one-way ANOVAs were conducted with perceived healthiness as the dependent variable, non-significant results were found for: the entire dataset $F(3, 272) = 1.49$, $p = .218$, the dataset using the SO Filter $F(3, 267) = 1.45$, $p = .228$, the dataset with the AC Filter $F(3, 250) = .98$, $p = .404$, and with both Filters $F(3, 243) = 1.07$, $p = .361$.

Status. Four one-way ANOVAs were conducted to observe the influence of watch colour on perceived status. The entire dataset, the dataset with the SO Filter, with the AC Filter, and with both Filters, all produced non-significant results (respectively: $F(3, 273) = 1.14$, $p = .332$, $F(3, 268) = 1.13$, $p = .336$, $F(3, 251) = 1.45$, $p = .228$, $F(3, 244) = 1.42$, $p = .238$). For the mediation model to produce useful information, a significant relationship needs to be observed between the independent and dependent variables. As colour condition did not have a significant influence on perceived attraction and sexual attraction variables, mediation was not conducted.

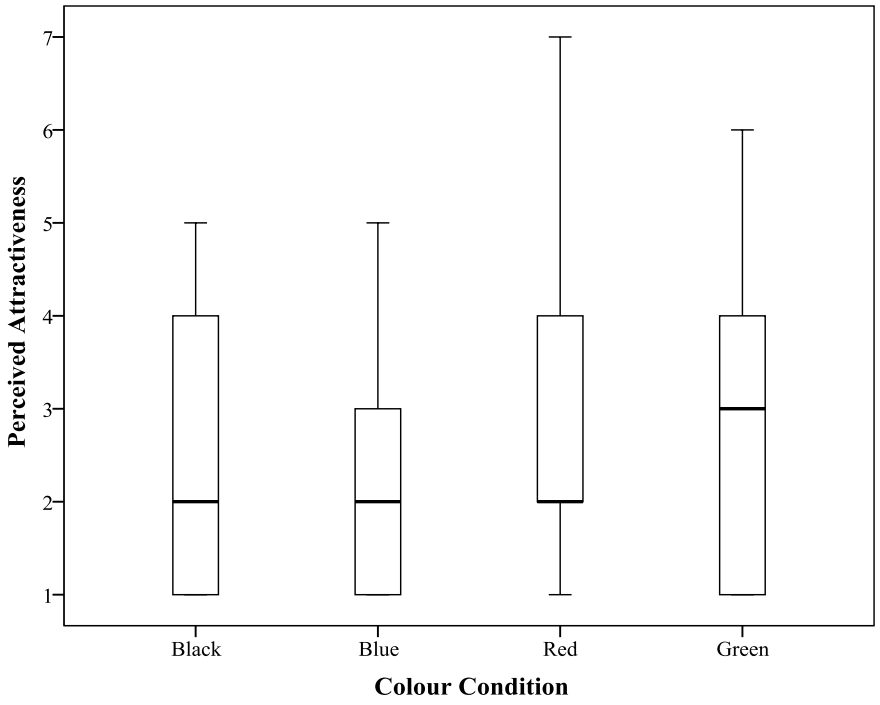

Figure 6. Box plots from Experiment 2 depicting perceived attractiveness as a function of watch colour. The whiskers beyond the upper and lower quartiles indicate the 1.5 IQR.

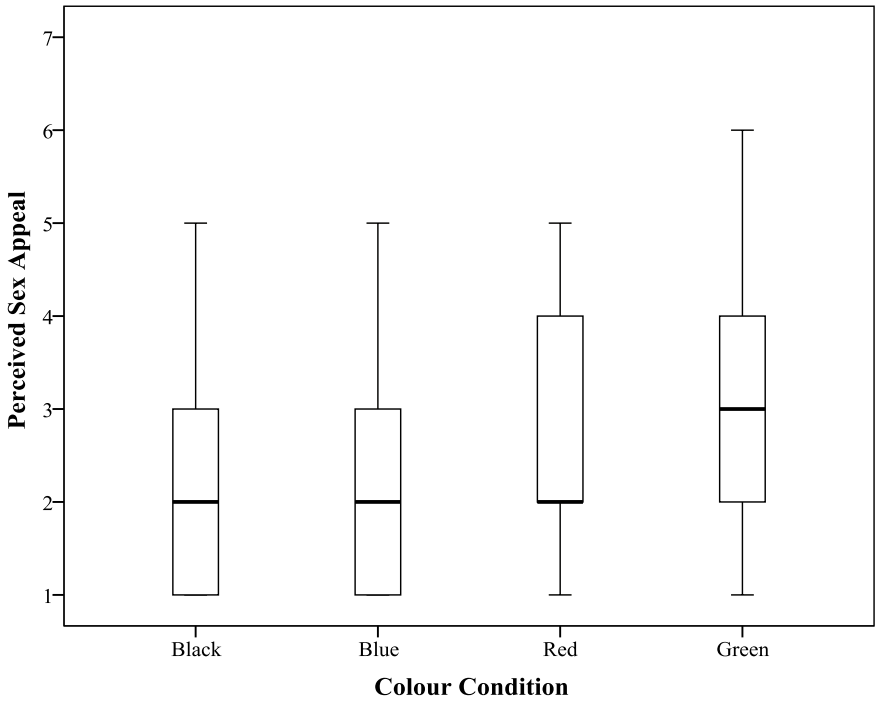

Figure 7. Box plots from Experiment 2 depicting perceived sex appeal as a function of watch colour. The whiskers indicate the 1.5 IQR.

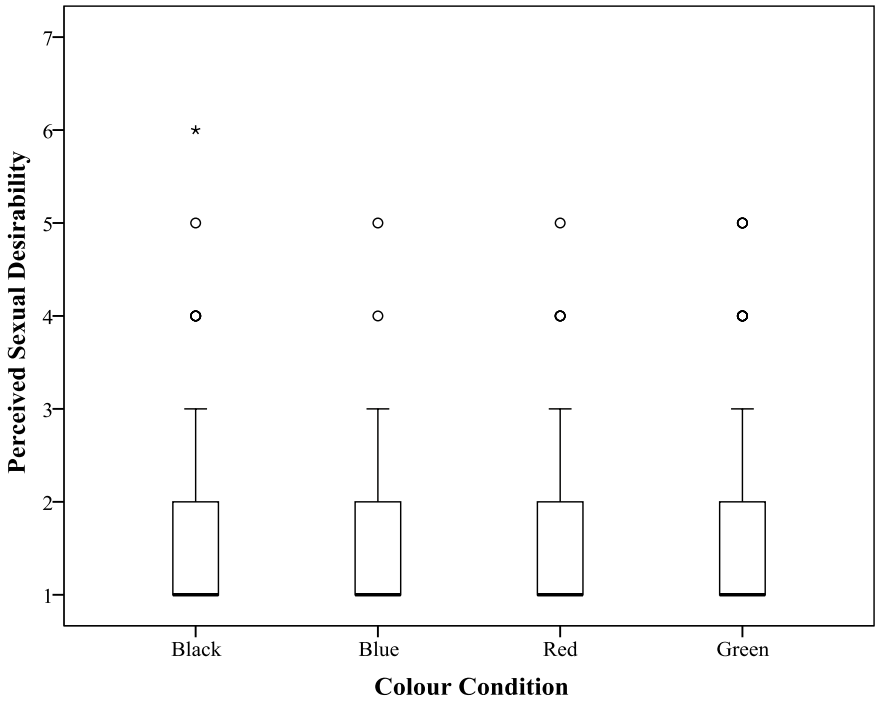

Figure 8. Box plots from Experiment 2 depicting perceived sexual desirability as a function of watch colour. The whiskers indicate the 1.5 IQR. Outliers are based on 1.5*IQR and extreme values are 3*IQR.

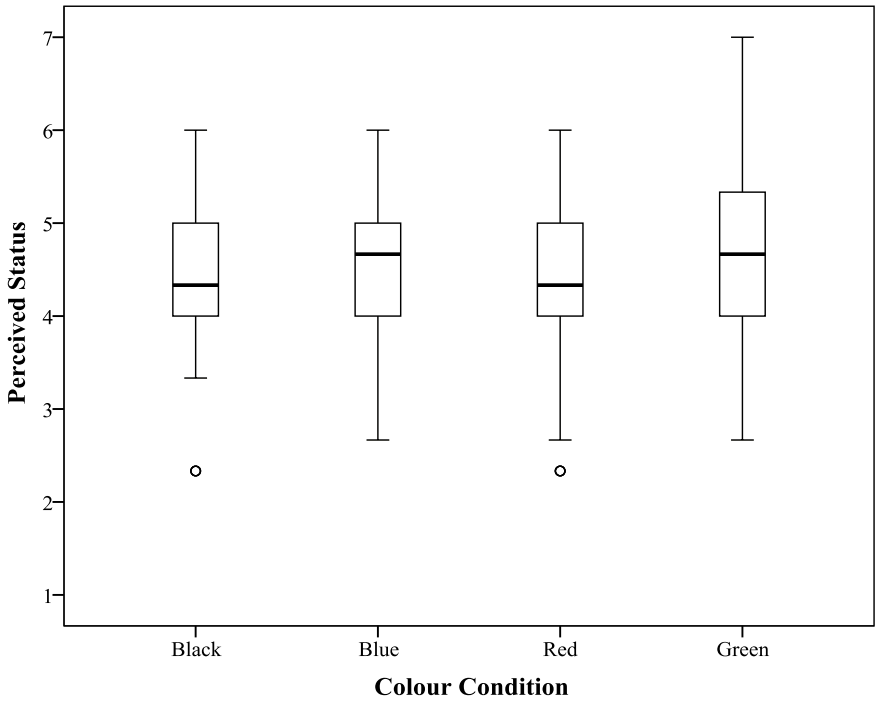

Figure 9. Box plots from Experiment 1 depicting perceived status as a function of watch colour. The whiskers indicate the 1.5 IQR. Outliers are based on 1.5*IQR.

Table 6

For Experiment 2, Showing Results of One-Way Bayesian ANOVAs on the Dependent Variables

Variable	Support For	BF_{10}	Evidence	*More Likely
Attractiveness	Null	0.123	Moderate	8.13
Sex Appeal	Alternative	1.457	Anecdotal	0.69
Sexual Desirability	Null	0.231	Moderate	4.33
Assertiveness	Null	0.102	Moderate	9.80
Healthiness	Null	0.076	Strong	13.16
Status	Null	0.112	Moderate	8.93

Notes. Support For = which hypothesis (null or alternative) the ANOVA provided support for. BF_{10} = Bayes Factor. Evidence = how much evidence is provided in support of the hypothesis (interpreted according to Jeffrey's (1961) classification categories), ranging from weakest to strongest: No Evidence, Anecdotal, Moderate, Strong, Very Strong, Extreme. *More Likely = times more likely the data occurred under the mentioned hypothesis, as calculated by $1/BF_{10}$.

Discussion

The results for Experiment 2 were inconsistent with Hypotheses 3 and 5. The results were supportive of those found in Experiment 1. The results for sex appeal were contradictory to previous research (Lin, 2014) as they found evidence for a green effect, rather than red. The results were supportive of Hypothesis 4 as no significant differences were found for assertiveness and healthiness.

We predicted that ratings of attractiveness, sex appeal, sexual desirability, and status would be higher in the red condition. The male with the red watch did not receive higher ratings of attractiveness (M = 2.59, SD = 1.38) than with the black (M = 2.37, SD = 1.50), blue (M = 2.21, SD = 1.24), or green watch (M = 2.78, SD = 1.46). On average, red scored the same as black and blue (see Figure 6), but green scored higher overall. The control colours were allocated more scores on the lowest possible option, compared to red. Red was also allocated the highest scores. If there were an effect, the direction may lean towards red, as well as green.

Contrary to our predictions, the male with the green watch (M = 2.91, SD = 1.41) was rated significantly higher on sex appeal than with the black (M = 2.28, SD = 1.38) and blue watch (M = 2.33, SD = 1.18). Whilst not significant, green (M = 2.91, SD = 1.41) also produced a higher average than red (M = 2.65, SD = 1.29). As shown in Figure 7, red displayed a distribution closer to that of green; although green had a higher average influence, red had more influence than black and blue. Red had more influence on sex appeal in Experiment 2 as opposed to Experiment 1 (see Figures 3 and 7).

The results for sexual desirability did not support our predictions; the male with the red watch (M = 1.60, SD = 1.00) was not rated significantly higher than with black (M = 1.61, SD = 1.11), blue (M = 1.42, SD = 0.73), or green (M = 1.86, SD = 1.24). The data for sexual

desirability were notably positively skewed (see Figure 8). Either females found the male very sexually undesirable, or felt uncomfortable answering. The results were different from those observed in Experiment 1 (see Figure 4), where some positive influence of red and blue were observed.

Further, there were no significant differences between perceptions of status and red (M = 4.40, SD = 0.89), black (M = 4.43, SD = 0.83), blue (M = 4.54, SD = 0.76), or green (M = 4.64, SD = 0.91). As shown in Figure 9, green received the highest scores. Green and blue were rated higher, on average, than black and red. Green appeared to have the most influence on perceptions of status. Contrary to our predictions, red, however, appeared to have the least influence. The lack of evidence for the romantic red effect is reiterated when we observe the results from the Bayesian ANOVAs.

As shown in Table 6, the one-way Bayesian ANOVAs conducted on attractiveness, sexual desirability, and status, provided moderate evidence for the absence of a colour effect. Although sex appeal was supported by anecdotal evidence for the alternative hypothesis, it was not in the direction we predicted; it was 0.69 times more likely the data occurred because of the presence of a green effect. Anecdotal evidence reflects minimal support, suggesting the apparent green effect was only marginally influential. Green, however, had the most consistent influence across the dependent variables. Arguably, red was a close second. Red had more of a positive influence in Experiment 2 than in Experiment 1. The equivalent influence of blue and red observed in Experiment 1 was not corroborated by findings in Experiment 2. In summary, these results suggest red did not have a significant influence on approach motivation of females viewing males.

General Discussion

The current research sought to replicate a previous experiment that found cross-cultural evidence for the romantic red effect (Lin, 2014, Experiment 1). In Experiment 1, we predicted that a red laptop, relative to black, blue, and silver, would significantly enhance males' perceptions of female attractiveness, sex appeal, and sexual desirability. Hypothesis 1 was not supported. Experiment 2 tested the romantic red effect on females viewing males. We predicted that a red watch, relative to black, blue, and green, would significantly enhance females' perceptions of male attractiveness, sex appeal, sexual desirability, and status. As non-significant results were found for the red condition, Hypotheses 3 and 5 were not supported. Contrarily, we observed a significant influence of green, relative to black and blue, on sex appeal. Although non-significant, green also scored a higher average on attractiveness (see Figure 6) and received the highest scores for status (see Figure 9). Evidence for a green effect was unexpected.

Green can be matched with red on chroma and lightness, allowing for a highly controlled test of hue (Elliot et al., 2010). As such, plenty of romantic red researchers have used it as a control colour (Elliot et al., 2010, Experiment 4; Elliot & Niesta, 2008, Experiment 4; Niesta Kayser et al., 2010, Experiment 1; Roberts et al., 2010 Experiments 1-3). Green has positive associations (Kaya & Epps, 2004). In the achievement domain, positive associations with green are outweighed by negative connotations with red (Elliot et al., 2009, Experiments 1-2; Elliot et al., 2007, Experiments 1, 5, & 6). Lichtenfeld et al. (2012), however, found evidence of a green effect in a creative achievement setting. They found that green, relative to white, black, grey, and red, significantly enhanced creative output. As colour associations can be transferred to the wearer (Elliot & Maier, 2012), could perceived creativity have acted as a mediator to increased perceptions of attractiveness, sex appeal, and status? It is plausible, but as creativity is not an important desirable trait for

females viewing males (Buss & Barnes, 1986; Li, Balley, Kenrick, & Linsenmeier, 2002), it is unlikely. Although we attribute the significant results for green simply to a preference for its hue and wavelength, we could have ruled out alternative explanations by measuring for other desirable traits, such as creativity. Previous research suggests minimal colour cues can influence impression formation (Bashir & Rule, 2014; Maier et al., 2013). We wanted to observe whether these findings extended to the affiliation domain. The questionnaire for Experiment 2 directed an unnatural amount of attention to the colour stimulus by presenting participants with a large photo of a watch and asking them to imagine it on the male. We remain unclear on the influence of minimal colour manipulation in the affiliation domain as we believe our methodology did not accurately measure it. Regardless, the findings suggest an absence of a red effect. These findings were corroborated by results from Experiment 1.

Findings from Experiment 1 suggest males are not more likely to approach females carrying a red laptop. Contrary to the original experiment (Lin, 2014, Experiment 1), red produced the lowest sex appeal scores of the four colours. The chromatic colours in Experiment 1 appeared to have more overall influence than the achromatic. Colours with hue and long wavelengths are preferable in general, and this preference can enhance initial perceptions (Elliot et al., 2010). Black was, however, allocated the highest scores on attractiveness (see Figure 2), which may provide minimal support to previous research (Roberts et al., 2010; Pazda et al., 2014). Overall, the findings from Experiment 1 failed to support previous results that demonstrate an influence of red on males viewing females (Elliot & Niesta, 2008; Pazda et al., 2012; Lin, 2014; Niesta Kayser et al., 2010; Schwarz & Singer, 2013), but supports null findings (Lynn et al., 2016; Peperkoorn et al., 2016). It is important to note the differences in sample sizes between the supportive and null findings.

The average sample recruited by Elliot and Niesta (2008) was 36.2, Lin (2014) recruited 80, whilst Pazda et al. (2012) averaged 32 and Niesta Kayser et al. (2010) averaged

22.5. Even successful replication attempts by Schwarz and Singer (2013, *N* = 120) and Pazda et al. (2014, *N* = 361) did not yield particularly high sample sizes. This is in contrast to Experiment 2, Lynn et al. (2016), and Peperkoorn et al. (2016, Experiment 3) (respectively *N* = 273, 1085, 869). As small samples contain less of the target population, their results are less generalizable. The results accumulated from the larger samples (Lynn et al., 2016; Peperkoorn et al., 2016), therefore, suggest the effect may not exist in the true population. Additionally, if we can ascertain that Experiment 1 was a close replication, we can rule out methodological differences and attribute our findings to an absence of an effect.

To reiterate, a close replication attempt must yield high statistical power (recruit 2.5* more participants) and ideally use the same stimuli, data analysis, and procedure as the original experiment (Brandt et al., 2014). Experiment 1 meets the first three requirements only. Lin (2014) conducted the experiment in separate meeting rooms. Participants in Experiment 1 completed their questionnaires where they were sitting in the university building when asked. This may have exposed them to extraneous influences, such as noise distractions, that were not present in the original experiment (Lin, 2014). Elliot and Maier (2012) explain how the impact of colour on psychological functioning varies across people as some pay more, or less, cognitive attention to the colour manipulation. Participants in Experiment 1 were not allocated a time frame, so some finished their questionnaire faster than others. It is plausible that environmental distractions and limited exposure rendered participants less susceptible to the influence of red. Further, although participants were asked to shield their questionnaires, peers sitting in proximity could have seen other colour conditions. Upon guessing the experimental hypotheses, participants may have adopted negative-participant roles; where they score lower to discredit the research (Weber & Cook, 1972). This could explain the consistent floor effects observed across the sex-related variables for Experiment 1 and 2 (see Figures 2-4 and 6-8). Social desirability can explain

why we observe particularly low scores for the more invasive sexual desirability question (see Figures 4 and 8). Extraneous variables present in Experiment 1, but not in the original experiment (Lin, 2014), may have overridden the true effect. Assessing answers to the colour check question, though, suggests that participants in the red condition did acknowledge the colour.

The laptop colours used in Experiment 1 (see Figure 1) were not easily distinguishable. If organizing participants as "correct" if they only included the one-word name of their corresponding colour condition in their answer, only 51.3% of participants answered correctly. With this filter, black drops from 68 to 49, blue from 67 to 19, and silver from 66 to 5. However, red only moves from 69 to 67, which suggests red was easily recognized and almost all participants in the red condition were paying attention to their questionnaire. It is unlikely, then, that findings from Experiment 1 were entirely attributable to differences in procedure. Furthermore, by filtering out participants that were considered less susceptible to a red effect (homosexual, colour-blind, and lacking-attention participants) we created a sample that were more likely to have been influenced by the romantic red effect. Still, we only observed very slight increases in the sex-related variables for Experiment 1, but none for Experiment 2 (see Appendices D1 and D2). More evidence for an absence of an effect is demonstrated by the consistent support for the null hypothesis, over the alternative (see Tables 3 and 6). Moderate to very strong evidence is provided against the presence of a colour effect.

In summary, we considered Experiment 1 a close replication attempt. The same stimuli, questions, and materials were used. We ensured high statistical power. Even after facilitating a more susceptible sample, we still found no evidence for a red effect. It could be that the true effect was only present in Taiwan. Results from Experiment 1 and 2 suggest marketers should take caution if claiming their red wearable technology products can elicit

approach motivation in the opposite gender. Future researchers should continue to hypothesis-test the romantic red effect to combat the recent null findings (current research; Lynn et al., 2016; Peperkoorn et al., 2016). Evidence for the romantic red effect in a large-scale replication would ascertain its existence in the true population. As Experiment 2 failed to accurately measure the influence of minimal red cues in the affiliation domain, future researchers could address this. The existence of a red effect would receive greater support if it were found to influence perceptions via a small stimulus. Finally, researchers using green as a control colour could measure for other desirable traits, such as creativity, so they can attempt to interpret evidence for a green effect, if they find one. We also advise future researchers to run analyses on various forms of filtered data as results may help ascertain limitations of the romantic red effect.

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Appendices

Appendix A

Informed consent form for Experiment 1 and 2 (for Experiment 2, “woman’s” was changed to “man’s”).

Dear participant,

You are about to participate in the study 'Person Perception 2017'. Before the study begins, it is important that you take notice of the procedure being followed in this study.

Research Purpose

The aim of this research is to see how individuals make a first impression of other people. We are specifically interested in interpersonal, sexual attraction.

Instruction and Procedure

The study consists of providing ratings of a woman’s photo. To begin with, we ask you to fill out some questions about yourself, such as your age and sexual orientation (you can leave this question blank, if you don’t want to provide this information). In total, participation will typically take between 2 and 5 minutes.

Voluntary Participation

If you decide not to participate in this study, this will have no consequences whatsoever. Also, you can stop your cooperation at any time during the study. Just return the survey to the researcher and say that you no longer want to take part.

You are free to do so without giving reasons. Given that data are processed anonymously it is not possible to withdraw your data after you returned a completed questionnaire.

You can be included in a raffle to win one of 10 cinema vouchers (€15,-) in compensation of your participation (only winners be notified).

Confidentiality of Research Data

The research data you provide will be used for master thesis and may be published in a scientific journal. During the study you won't be required to fill out your name or other directly identifiable information. Should you want to be included in the raffle you can include your email on this form. This consent form will be stored separately from the survey you complete.

If you have any further questions, you can ask the researcher or contact Dr. Thomas Pollet (t.v.pollet@fsw.leidenuniv.nl)

I have read and understood the above well and I agree to participate in this study.

_____

Date: _____

E-mail (if you want to be included in raffle): _____

I would like to receive information via e-mail on this study (after data collection is finalized): Yes / No

Appendix B

Debriefing for Experiment 1

The researchers verbally answered any questions the participants had. If participants indicated on their consent form (see Appendix A) that they wanted to receive more information about the experiment, the following email was sent to them once all data was collected:

A while back you kindly completed a short study for us. You indicated that you would like some further information, which is why we sent this e-mail

The purpose of this study is to test whether colour influences person perception and dependent on the condition the colour of the laptop (black, blue, silver, red) varied. This study is a replication of a previously published paper. (Lin, H., 2014. Red-colored products enhance the attractiveness of women. Displays 35, 202–205.)

Should you have any further queries then please do not hesitate to ask.

Dr. Thomas Pollet (t.v.pollet@fsw.leidenuniv.nl).

Appendix C

Debriefing for Experiment 2

The debriefing was the same as for Experiment 1: the researchers verbally answered any questions the participants had. If participants indicated on their consent form (see Appendix A) that they wanted to receive more information about the experiment, the following email was sent to them:

A while back you kindly completed a short study for us. You indicated that you would like some further information, which is why we sent this e-mail.

The purpose of this study is to test whether colour influences person perception and dependent on the condition the colour of the watch (black, blue, green, red) varied. This study is a follow-up study based on a previously published paper. (Lin, H., 2014. Red-colored products enhance the attractiveness of women. Displays 35, 202–205.)

Should you have any further queries then please do not hesitate to ask.

Dr. Thomas Pollet (t.v.pollet@fsw.leidenuniv.nl)

Appendix D1

Table Showing Means and Standard Deviations for the Dependent Variables in the Red Condition of Experiment 1, Based on Four Forms of the Dataset

	Entire Dataset		SO Filter Dataset		AC Filter Dataset		Both Filters Dataset	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Attractiveness	2.40	1.08	2.43	1.10	2.41	1.10	2.44	1.10
Sex Appeal	2.26	1.05	2.26	1.05	2.25	1.03	2.29	1.03
Sexual Desirability	2.13	1.21	2.20	1.21	2.10	1.20	2.17	1.21
Assertiveness	2.71	1.00	2.70	1.00	2.71	1.01	2.71	1.00
Healthiness	4.10	0.77	4.08	0.80	4.01	0.80	4.10	0.78

Note: SO Filter = Sexual Orientation Filter. AC Filter = Almost Correct Filter.

Appendix D2

Table Showing Means and Standard Deviations for the Dependent Variables in the Red Condition of Experiment 2, Based on Four Forms of the Dataset

	Entire Dataset		SO Filter Dataset		AC Filter Dataset		Both Filters Dataset	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Attractiveness	2.59	1.37	2.60	1.37	2.63	1.37	2.64	1.37
Sex Appeal	2.65	1.29	2.63	1.30	2.67	1.30	2.64	1.31
Sexual Desirability	1.61	1.00	1.58	0.97	1.60	1.00	1.58	1.00
Assertiveness	3.67	1.16	3.64	1.16	3.70	1.16	3.67	1.17
Healthiness	5.30	1.03	5.31	1.05	5.27	1.03	5.28	1.04

Status	4.40	0.90	4.40	0.90	4.37	0.88	4.38	0.90

Note: SO Filter = Sexual Orientation Filter. AC Filter = Almost Correct Filter.