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Automatic attention to sexual images of men and women in androphilic, ambiphilic, and gynephilic women.

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Abstract

Attentional resources might be automatically attracted to highly motivational stimuli such as a possible sexual partner. We tested whether attention would be automatically attracted to images of men vs women in women with a self-reported sexual attraction to men (androphilic), women (gynephilic) or to both men and women (ambiphilic) in a dot-probe paradigm. While androphilic women showed a small bias towards the female images, both ambiphilic and gynephilic women showed a strong bias towards the female images. The results show that these early automatic processes of attention are towards women in this sample of ambiphilic women and therefore inconsistent with their self-report sexual preferences.

Keywords: bisexual, ambiphilia, gynephilia, androphilia, spatial attention, dot-probe paradigm.

Automatic attention to sexual images of men and women in ambiphilia.

Many studies have now established that androphilic women's sexual reactions to various stimuli do not correspond closely with their self-reported attractions (Chivers, 2017; Suschinsky, Dawson, & Chivers, 2017). The lack of correspondence may be due to different measures being reliant upon different stages of the sexual response. Several models of sexual response (Dewitte, 2016; Janssen, Everaerd, Spiering, & Janssen, 2000; Spiering, Everaerd, & Janssen, 2003) contain stages of both automatic processes and controlled processes. For instance, the Information Processing Model (Janssen et al., 2000) contains two pathways. The first pathway, the appraisal pathway, is thought to be largely automatic and unconscious. That is these processes occur regardless of the person's intentions and consume little or no attentional capacity. The appraisal process matches the stimulus to memory elements and triggers attentional processes and genital arousal in a fast, automatic manner though this may then lead to the subjective experience of sexual arousal and further genital responses. The second pathway contains the more controlled processes and is slower and involves the conscious appraisal of the stimulus. These controlled processes are influenced by higher-order cognitions, such as the goals of the individual, and consume processing capacity. It is therefore possible that sexual attractions as assayed from the measurement of early automatic processes may not correspond to those assayed from later controlled processes. In this paper we looked to see if women's automatic allocation of spatial attention to images of men and women corresponds with their self-reported sexual preferences for androphilic (a sexual attraction to men), gynephilic (a sexual attraction to women) and ambiphilic (a sexual attraction of approximately equal magnitude to both men and women) women.

Given that our sensory systems have a limited capacity to process information there is a need for them to be directed to stimuli that might be particularly important. So, for instance, we may choose to attend to something if we think it might attack us or be something we can eat. These attentional processes are also thought to be under the control of both automatic and controlled processes (Nakayama & Mackeben, 1989) and can be measured by the actual movement of the sensory organs (e.g., through overt eye movements) or through movements of attention without eye movements - covert attention (Posner & Petersen, 1990). Stimuli that portray sexual content would, presumably, also be likely to attract attention given their importance.

The dot-probe task aims to measure the covert movement of attention. In a typical dot-probe paradigm two images are presented each side of a fixation mark, and then a target is presented at the location of one the images at the time of the removal of the images. The idea is that if attention has been attracted to one of the images more than the other then a target (a "dot-probe") appearing at this location would be better processed (e.g., faster reaction times and/or fewer errors) than a target appearing at the other location. The task was introduced by MacLeod, Mathews and Tata (1985), using words as cues, and showed that individuals with high anxiety were faster to detect probes that occurred at the location of threatening words in comparison to neutral words. The technique has proved immensely popular (e.g., as of July 2022, a PubMed database search of keyword "dot-probe" retrieves 993 studies) and has an established history in many clinical and research areas (e.g. eating disorders (Aspen et al. 2013), smoking (Drobes et al., 2019), substance abuse (Field et al, 2009), pain (Todd et al., 2018), phobias (Asmundson et al, 1994), etc.). The paradigm has also been successfully used in non-human species (van Rooijen et al., 2017). However, despite the numerous findings that indicate the validity of the

paradigm, there have been on-going concerns about the reliability of the task (Schmukle, 2005). Recent studies have also indicated poor reliability and have begun to examine ways in which this might be improved (see, for example Carlson & Fang, 2020).

The dot-probe paradigm has been used to study sexual attraction. For instance, Prause, Janssen, and Hetrick (2008) compared sexual images to neutral images. They found that people were slower for targets appearing at the location of sexual image compared to the location of the neural image. This is the opposite of their prediction and what might be expected from the idea that sexual images attract attention. The reasons for this result are unknown, but the authors speculate that the attention to the sexual images may have engaged the participant and left fewer resources available to process the target. Other studies have reported no significant bias either towards or away from sexual stimuli (Nolet, Emond, Pfaus, Gagnon, & Rouleau, 2021; Novák, Bártová, Vagenknecht, & Klapilová, 2020) while others have found the expected bias towards sexual stimuli though with small effect sizes (Brauer et al., 2012; Doornwaard, van den Eijnden, Johnson, & ter Bogt, 2014; Kagerer et al., 2014; Mechelmans et al., 2014; Pekal, Laier, Snagowski, Stark, & Brand, 2018).

While the study of Prause et al. (2008) and the others reviewed above compared images of sex to neutral stimuli, Snowden, Curl, Jobbins, Lavington, and Gray (2016) compared images of men to images of women. Heterosexual (gynephilic) men showed a strong dot-probe effect with faster reaction times to probes at the location of images of women compared to those at the location of images of men. However, heterosexual (androphilic) women had similar reaction times to probes at either location. The authors interpret their results in terms of the idea that the automatic sexual appraisals of gynephilic men are category-specific, whereas those of androphilic women are not category-specific and note the similarity of these results to those

found in studies of genital responses (Chivers, Rieger, Latty, & Bailey, 2004). However, this study did not examine the response of non-heterosexual participants of either gender. It should be noted that the study of Ziogas, Habermeyer, Kawohl, Habermeyer, and Mokros (2021) also examined automatic spatial attention to images of men and women in both gynephilic and androphilic men and found no evidence for an attentional bias in either group.

A second difference between the studies of Prause et al. (2008) and Snowden et al. (2016) is in the duration between the onset of the cue and the onset of the target. The study of Prause et al. (2008) used 500 ms which appears to be the modal value for studies using the dot-probe task. However, Snowden et al. (2016) argue that at 500 ms there is time for more than one shift of attention and such a long time interval may not be able to isolate the early automatic shifts of attention (see also Cooper & Langton (2006) for how spatial attention to faces may change with time interval) and argue that a much briefer time interval is needed. The study of Snowden et al. (2016) therefore used a time interval of 200 ms and this was copied for the present study.

While the dot-probe task has been used to investigate many psychological processes (Price et al., 2015) there have been on-going concerns relating to the reliability of the task (Jones, Christiansen, & Field, 2018; Schmukle, 2005; Staugaard, 2009). Few of the studies cited above which have examined sexual stimuli using the dot-probe task have reported on the reliability of the task. Novak et al. (2020) present split-half reliability for each of the conditions (e.g. trials on which the target appeared at the location of the sex images) and show high (> .85) reliability. However, this analysis only examines people's overall RTs and not the differential effects of the cues. The only study that has reported on reliability of the difference scores due to the differnet cues is that of Snowden et al. (2016). Here "moderate" reliability (r = .55) was demonstrated. Such a figure is below that accepted for non-RT measures (where the figure of r > .70 is

typically regarded as acceptable; Tavakol and Dennick, 2011) but is well above figures reported for other dot-probe tasks (see Parsons, Kruijt, and Fox, 2019). Of course, if should be remembered that the reliability of any task is not only a function of the error variance of the task itself, but also the variance between individuals (Hedge, Powell, & Sumner, 2018). It may be that some dot-probe tasks do not produce strong individual differences (in relation to the error variance) and hence will show poor reliaibility. However, in cases where we might expect quite large individual differences (such as in sexual attraction to males or females) reliability levels may be more acceptable. The present study therefore examined the reliability of the sexual dot-probe task as recommended (Parsons et al., 2019).

Dawson, Fretz, and Chivers (2017) used a paradigm that has some resemblance to the dot-probe paradigm. Two images (one of a man and one of a woman) appeared simultaneously at either side of a fixation mark and they monitored overt eye movements in relation to these two stimuli. They found that androphilic women spent more time looking at the images of men, which is in line with their self-reported attractions. However, their time taken to move the eyes was approximately equal whether this movement was to a male target or a female target and suggest this measure is reflective of the automatic processes. Again, these results point to the idea that in androphilic women the automatic sexual appraisals of a stimuli are category non-specific, while the more controlled processes are category specific. The study of Dawson et al. (2017) also included women that were not exclusively androphilic. Gynephilic women showed strong category-specific responses (supportive of attraction to women) for both their first fixation latencies and their total fixation duration. Ambiphilic women showed approximately equal total fixations times to images of men and women but faster latencies to images of women. So, for all groups the time spent looking at the images was consistent with their self-reported

attractions, but their latency to first fixation was only congruent with this in the gynephilic group.

While the study of Dawson et al. (2017) is important there are some limitations. First, the latency to first eye movement isn't necessarily a measure of automatic processes. Studies have shown that while the covert movement of attention is automatic, the overt movement of the eyes is not (though it is likely to be influenced by automatic processes – Hunt, Reuther, Hilchey, and Klein, 2019). It is also noteworthy that the latencies to eye movements in their study were over 1000 ms. This is clearly long enough for controlled processes to have a strong influence, if not total control, of the movement (Müller & Rabbitt, 1989).

In the present study we have used the dot-probe paradigm to examine responses to sexual images in women with androphilic, ambiphilic, and gynephilic preferences according to their self-reported categorisation. The images used appeared only briefly on the screen (200 ms) to isolate early automatic evaluations of these stimuli. On the basis of previous results, including those of Dawson et al. (2017), we predicted that androphilic women would show approximately equal attraction to both men and women, whereas both ambiphilic and gynephilic women would greater attraction to the images of women.

Methods

The study was conducted in two parts to obtain a large sample of women with a range of self-reported sexual orientations. All procedures for these experiments were given ethical permission from the Ethical Committee of the School of Psychology ,Cardiff University and the Ethical Committee of the Department of Psychology, Swansea University.

Participants.

A power analysis calculated that to detect a medium effect (F = .025) with an alpha of .05, and a power of 80% a sample size of 159 was required. The total sample size recruited was 169.

The Cardiff sample were recruited from a range of advertisements using Facebook and Twitter. We also handed out leaflets and recruited participants from various events including BiFest Wales, PrideCymru mardi gras, and the LGBT+ Society of Cardiff University. We encouraged participants to inform their friends about the experiment. We did not advertise for one or more particular group of people or sexual interest but stressed that we were interested in human sexuality and that we wished to test people of all sexual interests. The leaflets/advertisements asked for participants willing to take part in our experiments. They stated that the experiments would involve images of a sexual nature and we would be asking them about their sexual interests and behaviors. People who agreed to be contacted gave contact details. They were then contacted to arrange a time to be tested. In all, 73 cisgender women were successfully recruited through this method. Their mean age was 24.2 (SD = 6.2, range 18 – 51) and with a mean Kinsey score (see below) of 2.5 (SD = 2.0 range 0 – 6).

The Swansea sample were recruited from a range of advertisements across the University campus and on using Facebook and Twitter. The leaflets/advertisements asked for participants willing to take part in our experiments. They stated that the experiments would involve images of a sexual nature, would involve the viewing of images of naked people, and we would be asking them about their sexual interests and behaviors. People who agreed to be contacted gave contact details. They were then contacted to arrange a time to be tested. In all, 96 cisgender women were successfully recruited through this method. Their mean age was 27.9 (SD = 9.8, range 18 – 56) and with a mean Kinsey score (see below) of 2.3 (SD = 2.3 range 0 – 6).

Procedures.

Before testing took place, participants were given a detailed information sheet that explained the nature of the experiments and questionnaires and that the data from the tasks would be kept confidential. They were encouraged to ask questions about the tasks and procedures. They were allowed to see a sheet of paper on which all the stimuli to be used were printed. They then signed a consent form. They then completed a demographic questionnaire and questions about how they described themselves in terms of their sexuality, the Kinsey scale (Kinsey, Pomeroy, & Martin, 1948), and a feeling thermometer about their sexual interests. Participants then completed a battery of tests that looked at different aspects of their sexuality and included both physiological recordings and behavioural tasks. The dot-probe task was completed as the last task in this series.

Stimuli and materials.

Demographic Information.

Participants were presented with a demographic sheet that asked for their age, gender, and Kinsey scale rating (see below).

Kinsey Scale.

Sexual attraction was evaluated by a Kinsey scale with seven options. Option 0 was labelled as "*Exclusively attracted to the other gender",* option 3 was labelled as *"Equally attracted to both genders"* and option 6 was labelled as *"Exclusively attracted to the same gender*". The seventh option was an "*X*" and was labelled "*non-sexual or other*".

Feeling thermometer.

Direct ratings of feelings toward the construct pairs "sex with men" and "sex with women" were obtained using the feeling thermometer, which employs the heuristic of a

thermometer. Participants rated feelings from “cold/unfavourable” at zero to “warm/ favourable” at one hundred by circling the appropriate number on the scale.

Dot Probe task

The dot-probe task was the same as that used by Snowden et al. (2016). The participant’s task was to identify the location (left vs. right) of a small faint test dot (1 cm diameter, grey approximately 40 cd/m^2) on a white background (approximately 80 cd/m^2) that appeared after the cueing pictures. Each trial commenced with a fixation cross (1000 ms) in the middle of the screen. This was followed by the cue stimulus (200 ms). The cue always consisted of two images, for instance one of a woman and one of a man, each centred 12 cm from the middle of the screen. The cue was then replaced with the test stimuli (the dot) which was also centred 12 cm from the middle of the screen and remained until a response was made.

The stimuli used as cues consisted of eight pictures of men (all pictures were taken from the International Affective Picture System (IAPS: (Lang, Bradley, & Cuthbert, 1997); IAPs nos.: 4460, 4470, 4490, 4503, 4520, 4534, 4550, 4561) and eight pictures of women (IAPs nos.: 4002, 4003, 4141, 4142, 4210, 4232, 4235, 4240). The pictures contained images of genitals (male image = 5; female image = 6) or were partially naked (male image = 3; female images = 2). Images were presented in color.

To make the cues each of the eight male pictures was chosen in turn and a picture from the females was chosen as a foil. Foils were chosen to approximately match the male picture in terms of features such as the race of the person, their approximate pose, and whether the genitals were visible. Cues were produced with the male on the left (and female on right), and with the male on the right (and female on left), resulting in 16 cues. The process was then repeated using the next best foil, so that we had a total of 32 cues.

The experiment consisted of 192 trials: 64 contained male vs female cues whose data are reported here. The experiment also had trails that compared male cues to neutral cues (64 trials), and female cues to neutral cues (64 trials). Data from these comparisons to neutral trials are not presented here for brevity but are available in the Supplementary materials. The target appeared at either location on a random basis and the order of trials was randomised for each participant. Reaction times and errors were recorded.

Data Analysis.

The participants were grouped according to their Kinsey ratings (Kinsey Rating 0 or 1 = androphilic, 2-4 = ambiphilic, and 5 or 6 = gynephilic).

Trials on which errors occurred were removed but recorded. Four participants data were removed due to excessive error rates (> 25%). RTs less than 300 ms or greater than 1000 ms were removed then the mean RT for each of the conditions was calculated for each participant. The data from the RTs were inspected visually and appeared skewed so were transformed by a reciprocal transform. The transformed data showed no departure from a normal distribution (Kolmogorov-Smirnov) and were used for the statistical analyses. However, the raw data are used for the figures and tables. Given the small differences in the tasks between the two samples (and possible differences in the nature of the samples) we first performed tests with sample (CU vs SU) as a factor. However, no interactions involving this variable were found and so this was not included in the main analyses. The reliability of the task was assessed by dividing the trials into odd vs even trials and calculating the attention index (RT_{male} - $RT_{female;}$ see below) for each group of trials. The correlation between the attention index for the odd and even split was calculated and corrected for loss of trials by the Spearman-Brown prediction formula to give the estimate of reliability.

Results

Feeling Thermometer.

For the explicit ratings the data were bimodal and hence non-parametric statistics were used. For the Feeling Thermometer, androphilic women (n = 78) gave more highly favourable ratings to sex with men than sex with women (95.6 vs 19.7; Z = 7.58, $p < .001$; g = 4.12) while gynephilic women (n = 43) showed the opposite bias (16.1 vs 90.9; Z = 5.16, $p < .001$; g = 3.25). The ambiphilic women (n = 48) showed slightly higher ratings to sex with men (82.7 vs 72.7; Z = 2.10, p = .04 (two-tailed); g = 0.41.

Dot Probe Task.

Data from one androphilic participant were corrupted and could not be used. Five participants were removed due to excessive error rates (> 25%).

The RT data are shown in Figure 1 (left panel). A two (target: target after male, target after female) by three (group: androphilic, ambiphilic, gynephilic) ANOVA showed no main effect of group ($F(2, 160) = 1.58$, p = .21, η_p^2 = .02) but a main effect of target ($F(1, 160)$ = 83.74, $p < .001$, η_p^2 = .34). This was modified by a significant interaction between group and target ($F(2, 160) = 9.52$, $p <$ .001, η_p^2 = .11.

To understand this interaction, a bias towards women score was calculated as the RTs for the trials when the target appeared at the location of the male cue compared to when it appeared at the location of the female image (RT_{male} - RT_{female}) and these are plotted in Figure 1 (right panel). The score was significantly different from zero for all three groups (androphilic = 7.7 ms: $t(76) = 3.04$, p = .003, d = 0.35; ambiphilic = 39.8 ms: $t(42) = 5.98$, $p < .001$, d = 0.75; gynephilic = 45.7 ms: $t(42) = 5.40$, $p < .001$, d = 0.73). The size of this effect was smaller for the androphilic group in comparison to the amphiphilic group (Δ = 32.1 ms: $t(118) = 4.11$, $p < .001$, g = 0.78) and in comparison to the gynephilic group (Δ = 38.0 ms: $t(118) = 3.23$, p = .002, g =

0.61). The ambiphilic and gynephilic groups did not differ significantly (Δ = 5.9 ms: $t(84)$ = 0.79, p = .43, g = 0.17).

Reliability

The reliability of the dot-probe task was examined via a split-half reliability test. The trials were divided into odd and even trials and the bias scores were calculated for each set of trials. These scores were correlated (r = 0.22, p = .005) which translated to a reliability index of 0.36 after applying the Spearman-Brown formula for loss of trials due to splitting.

Discussion

The data clearly show a discord between women who self-report being ambiphilic in terms of their explicit statement of approximately equal sexual attraction to men and women (with a slight preference towards men) and the automatic attraction of spatial attention which was towards women. For the androphilic and gynephilic women, the results were like those of previous reports (Snowden et al, 2016) with androphilic women showing little automatic attentional bias to one of the genders, but gynephilic women showing strong attention to images of females.

Comparison to Previous Dot Probe Tasks

While the dot-probe task has been used extensively to examine automatic attention to sexual vs not-sexual images (see Strahler, Baranowski, Walter, Huebner, & Stark, 2019) there are few studies that have examined preferred vs non-preferred sexual stimuli (e.g., male vs female stimuli) and none that have examined this issue in non-androphilic women. In two studies, Snowden et al. (2016) found that androphilic women either did not show any gender bias or a small bias ($\approx$ 17 ms) towards female stimuli. However, the present study found a small bias ($\approx$ 8 ms) towards male stimuli. Together these data suggest that any bias is small and might well

depend upon the sample used. In contrast, both the ambiphilic and gynephilic women had a clear bias towards the female stimuli with medium to large effect sizes.

The dot-probe task aims to examine covert movements of attention. However, attention can also be inferred from the overt movements of the eye which were thought to be tightly linked to covert attention (e.g. Moore & Fallah, 2001), but more recent evidence is suggesting a looser connection (see Hunt & Kingstone, 2003; Li, Pan, & Carrasco, 2021). Some studies have presented two images (one of each gender) simultaneously in a paradigm that strongly resembles that of the dot-probe paradigm and examined patterns of eye-movements. For instance, Vásquez-Amézquita et al. (2019) showed that androphilic women's initial gaze direction was approximately equally distributed to either image whereas gynephilic women tended initially to fixate the female image (see also Dawson & Chivers, 2019; Dawson et al., 2017; Vásquez-Amézquita et al., 2018). Notably, these studies also found that a measure of "controlled attention" (the amount of time spent looking at each image) showed a different pattern of results with androphilic women spending more time looking at the male images, and gynephilic women looking more at the female images. The study of Dawson et al. (2017) also included a sample (n = 37) of ambiphilic women. Here the initial attention was towards the female stimuli (with a large effect size). Hence, the results of these studies of initial eye-fixations are very consistent with the pattern of results presented here using the dot-probe paradigm. Both indicate that these early automatic movements of attention (both overt and covert) are towards female stimuli in women who self-report approximately equal sexual attraction to men and women.

Comparison to other Measures of Sexual Attraction

According to the Information Processing Model of sexual arousal (Janssen et al., 2000) genital arousal is initiated by the automatic sexual evaluation of the stimulus that also guide

attentional resources (though full-blown genital arousal is also dependent on controlled processes). Hence, we might expect to see results from the analysis of genital responses mirroring those reported here for spatial attention. Timmers, Bouchard, and Chivers (2015) measured genital arousal (via vaginal photoplethysmography) in a sample of women with mixed-gender sexual interests to audiovisual films that differed in terms of level of sexual activity. They found a consistent pattern of greater responses to stimuli depicting females than those depicting males, and this occurred across the range of levels of sexual activity. Similar results were reported by Bouchard, Timmers, and Chivers (2015) to auditory stimuli and were extended to show this pattern for several different operationalisations of bisexuality (orientation, identity, romantic, fantasy, and behavior). Hence, data from direct measurement of genital responses appear to support the present findings of greater responses to female stimuli in ambiphilic women.

Another popular measure of "arousal" is the dilation of the pupil in response to sexual stimuli (Hess, Seltzer, & Shlien, 1965). In a recent meta-analysis Attard-Johnson, Vasilev, Ó Ciardha, Bindemann, and Babchishin (2021) attempted to summarise results from men and women of different sexual orientations/attractions. However, it is notable that they were unable to provide data on ambiphilic women due to a paucity of studies in this area. Two studies have attempted to address this issue. Rieger, Savin-Williams, Chivers, and Bailey (2016) had participants watch videos depicting men or women masturbating that lasted many seconds (> 30 s). The data from the women who self-reported their sexual orientation near the middle of the Kinsey scale appear to show that they had greater responses to the male stimuli than the female stimuli, and these responses were very similar to those of androphilic women. Snowden, McKinnon, Fitoussi, and Gray (2019) used relatively brief (2 s) presentation of static images of nude males or females. They too showed ambiphilic women to have greater responses to the

male stimuli. However, several of the results from this particular study appear at odds with others in the literature. For example, all groups showed greater pupil dilation to nude males than any other stimulus. The authors therefore questioned whether their paradigm and dependent variable reflected sexual arousal or some other form of arousal such as novelty or threat from viewing images of naked men - see also Attard-Johnson et al. (2021). Hence, both of these studies (Rieger et al., 2015; Snowden et al., 2019) appear to show greater dilation of the pupil when viewing male sexual stimuli than female sexual stimuli in ambiphilic women. Such results appear at odds with the results from the present study and from those measuring genital responses (see above). Given the relative lack of data from pupil studies, and the possibility that some paradigms may be measuring arousal that is not necessarily due to sexual attraction, further work is needed to understand why these different measures appear to be pointing to different patterns of arousal/attraction.

Limitations and Future Directions.

The main limitation of the present study lies in the relatively poor reliability of the dot-probe task. As discussed in the Introduction, this appears to be a general problem for this paradigm rather than one confined to the measure of sexual attraction (Jones et al, 2018; Schmukle, 2005; Staugaard, 2009). This unreliability severely hampers any attempt to use such a paradigm as a test of an individual's status or change in such status (Price et al., 2015). It also means that the effect sizes we report here might well be much larger if the paradigm can be made to be more reliable (Parsons et al., 2019). This area is being actively explored in terms of possible new scoring procedures (Evans & Britton, 2018; Price, Brown, & Siegle, 2019) and recommendations for the details of the task (Carlson & Fang, 2020; Aday & Carlson, 2019). In

line with Parsons et al. (2019), we recommend that future studies of sexual attraction using cognitive techniques such as the dot-probe task report on the reliability of the task(s).

The second limitation comes from the selection of the stimuli used as cues. For comparison purposes we chose to use the same cue stimuli for all three groups of women in the present study. However, it is possible that what is sexually attractive (in either a man or a woman) might differ as a function of sexual orientation. Bespoke studies using only images that are seen as attractive by the individual being tested may be warranted.

The present study chose to use a cue to target interval of 200 ms to isolate the early automatic components of visual attention. However, most studies using the dot-probe paradigm tend to use somewhat longer intervals (with 500 ms being the modal value). Further studies may wish to examine the importance of the cue to target interval and the possible later influence of more controlled processes with respect to attentional capture. Likewise, while we also used trials that contained neutral cues (see Supplemental Materials) we did not use a condition where both cues were neutral. Such trials have been used in previous research (not related to sexual attraction) to examine whether the attentional effects are due to the fast capture of attention by the cue, or due to a slower disengagement from the cue (see Koster, Crombez, Verschuere, & De Houwer, 2004).

Author contributions.

Robert Snowden helped design the study, performed the statistical analysis, and contributed to the writing of the manuscript.. Nicola Gray helped design the study, contributed to participant recruitment, helped write the manuscript, and supervised the students. Jasmine

Rollings and Katie Uzzell helped design the study, collected the data and commented on the manuscript.

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Aimee McKinnon contributed to the development of this study.

Declaration of Interest

The authors report there are no competing interests to declare.

Data Availability Statement

The data that support the findings of this study are openly available in Mendeley Data at http://doi: 10.17632/jwtfv6n4by.1

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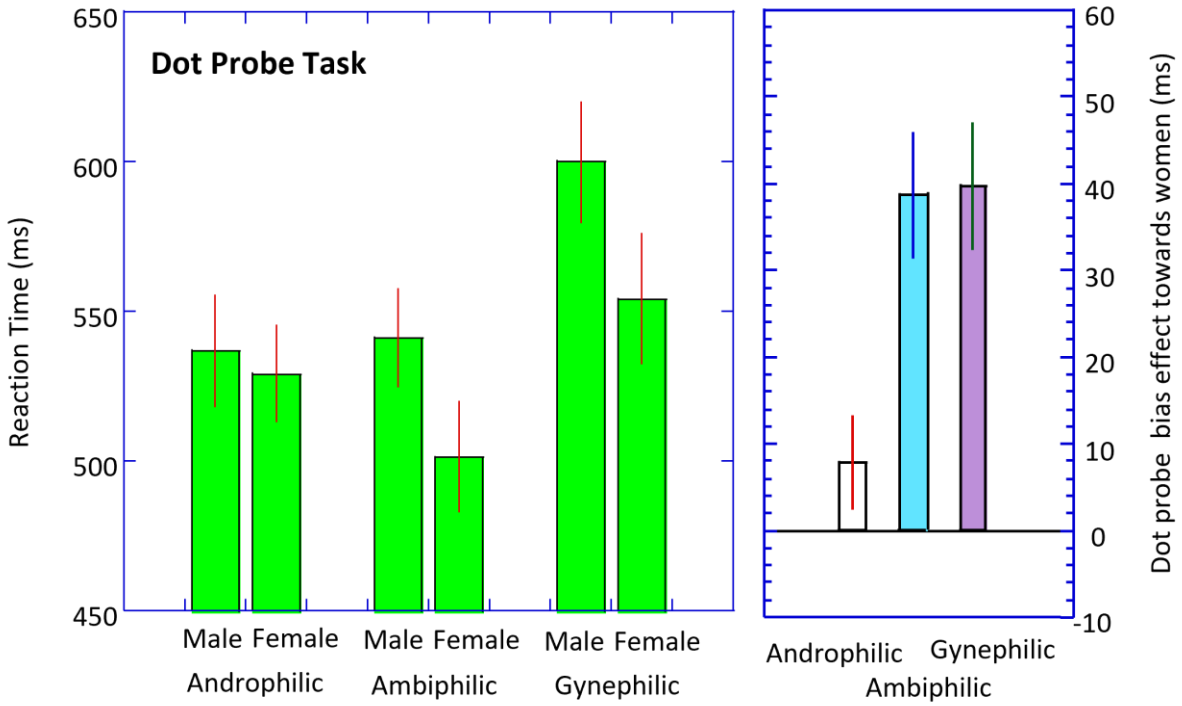
Figure 1. Left panel. Reaction times are plotted for targets appearing at the location of the male image and female image for the three groups. Error bars represent ± 1 SEM. Right panel. Bias score towards women ($RT_{men} - RT_{women}$) are plotted for the three groups. Error bars represent ± 1 SEM.



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Supplemental Information

Figure. Left panel. Reaction times are plotted for targets appearing at the location of the male or female images, male or neutral images, and female or neutral images, for the three groups. Error bars represent ± 1 SEM. Right panel. Bias scores towards the first category (female, make, female respectively) are plotted for the three groups. Error bars represent ± 1 SEM.