Viewing Time Effects Revisited: Prolonged Response Latencies for Sexually Attractive Targets Under Restricted Task Conditions

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ABSTRACT

Sexually attractive stimuli are watched longer than unattractive stimuli. The processes underlying this robust and reliable viewing time effect are presently not well understood. In the present research comprising four experiments (total $N = 250$), four classes of potential explanations are proposed and the derived implications were experimentally tested. Contrary to explanations based on either deliberate delay or attentional adhesion to sexually attractive stimuli, prolonged response latencies were also found under restricted task conditions. Sexually preferred targets elicited longer response latencies in a self-paced evaluation task when stimulus pictures were presented for 750 ms (Exp. 1) or for 500 ms and followed by a pattern mask (Exp. 2). Prolonged latencies for sexually preferred targets were also observed when sexual attractiveness was rated in a speeded binary decision task with a response window of 1000 ms (Exp. 3). Eventually, it was shown that the response latency effect in the speeded binary choice task was still preserved when only the heads of target individuals were presented instead of the bodies (Exp. 4). Mate identification and schematic processes are discussed as the remaining plausible mechanisms for prolonged response latencies for sexually attractive targets under restricted conditions.

KEY WORDS: Viewing time, sexual preference, sexual interest, visual reaction times, indirect measures

INTRODUCTION

Over the last decade, the indirect assessment of sexual preferences has received growing attention. Direct measures of sexual preference, such as questionnaires and clinical interviews, rely on participants' willingness and ability to accurately report information about their sexual interest for assessing sexual preference. Therefore, the usefulness of such direct methods is particularly questionable in the forensic context where denial and dissimulation of deviant sexual interest can be expected if assessments are part of legal proceedings. As an alternative to self-report methods, a number of indirect measures have been proposed, such as penile plethysmography (PPG; e.g., Freund, 1963), the Implicit Association Tests (IAT; e.g., Gray, Brown, MacCulloch, Smith, & Snowden, 2005), the Choice Reaction Task (CRT, Choice Reaction Task; e.g., Wright & Adams, 1994), and viewing time measures (e.g., Harris, Rice, Quinsey, & Chaplin, 1996).

These instruments infer sexual preference from objective measures either based on physiological indicators of sexual arousal or response latencies. Both approaches have in common that reactions elicited by stimuli showing target persons belonging to groups of sexual interest (men vs. women, children vs. adults) are recorded. The measurement rationale relies on the fact that certain stimulus categories induce more sexual arousal as indicated by stronger tumescence (PPG), that certain classes of target individuals are more strongly semantically associated with the concept of sex or sexual interest than others (IAT), or that sexually preferred stimuli function as distracters that interfere with performance in a primary task (CRT).

Viewing Time Measures

Since the seminal work of Rosenzweig (1942), it is well established that pictures of sexually attractive persons are watched longer than pictures of sexually unattractive persons

when sexuality is salient. This basic effect is so reliable and robust that it is used for the indirect assessment of sexual preferences in forensic settings (e.g., Abel et al., 2001). However, whereas the underlying processes of most other indirect measures of sexual preference are relatively well established, surprisingly little is known about the mechanisms underlying viewing time effects. In the standard viewing time procedure, participants are asked to evaluate pictures of target individuals on a graded scale of sexual attractiveness. The response latency of this judgment is unobtrusively measured. Across studies, there is a very robust finding that the response latency is longer for sexually attractive as compared to sexually unattractive targets and, in turn, viewing time measures can be used to discriminate between participants with respect to sexual preference (Flak, Beech, & Fisher, 2007; Kalmus & Beech, 2005; Laws & Gress, 2004), including homosexual and heterosexual men (Zamansky, 1956), heterosexual men and women (Israel & Strassberg, 2009; Quinsey, Ketsetzis, Earls, & Karamanoukian, 1996), and child sex offenders and non-offenders (e.g., Banse, Schmidt, & Clarbour, in press; Gress, 2005; Harris et al., 1996). The discriminatory ability of viewing time measures has been claimed to be similar or even superior to phallometric measures (e.g., Abel, Huffman, Warberg, & Holland, 1998) but in a recent critical review of the VT literature Sachsenmaier and Gress (2009) propose that "studies have yet to determine, whether the measure is at least as accurate as or perhaps more so than PPG" (p. 55). However ,recent evidence suggests that VT measures outperform other indirect measures like the IAT (Banse et al., in press).

Despite the robustness of the viewing time effect, there seems to be virtually no empirical research on the underlying mechanisms. Also, theoretical accounts are sparse. In review articles, the viewing time effect is commonly introduced at the descriptive level without further theorizing. For example, Laws and Gress (2004) stated that “the rationale underlying the test is

that clients will look longer at pictures they find sexually attractive" (p. 184). Others (e.g., Flak et al., 2007; Kalmus & Beech, 2005) categorize viewing time measures as "attentional techniques" and argue that "assessments measuring viewing time assume that individuals will look longer at images they consider attractive than they would view unattractive or neutral images", explicitly distinguishing it from other techniques that "discriminate the effect of increased attention upon information processing tasks" (Kalmus & Beech, 2005, p. 208).

As a background theory, scholars in the area of forensic research often refer to Singer's (1984) model of sexual arousal (e.g., Flak et al., 2007; Kalmus & Beech, 2005) according to which sexual arousal consists of three consecutive phases. The first reaction is termed *aesthetic response*, a "hedonic feeling in response to a sexual stimulus" (pp. 232-233) that "develops into a more active orientation toward the sexual stimulus" (Singer, 1984, p. 233), followed by an approach step, and then a third step of physiological genital response. The attentional process described as an aesthetic response is generally believed to cause the viewing time effect (e.g., Kalmus & Beech, 2005). Others take an evolutionary psychology perspective by postulating that longer viewing time may be adaptive for mate seeking because "it reflects the initial stage of courtship, locating and evaluating an appropriate partner" (Quinsey et al., 1996). Sexual attraction is closely related to reproduction; therefore, it seems plausible that the cognitive system has adapted to directing attention to potential sexual mates, i.e., sexually preferred individuals (Redouté et al., 2000). However, in evolutionary psychology, a satisfactory explanation of a phenomenon requires that there is an understanding not only of ultimate but also proximal mechanisms that cause the observed behavior. Thus, although both Singer's theory of sexual arousal and the evolutionary psychology approach offer a starting point, very little is known about the actual psychological mechanisms that cause the effect of prolonged viewing

times for sexually attractive targets. It is the aim of the current research to specify four alternative accounts of the underlying processes and to test them empirically.

Deliberate Delay

First, the most parsimonious explanation of why judgment of sexually highly attractive stimuli is prolonged is that watching those stimuli is rewarding and that terminating this by any response is therefore deliberately delayed. This hypothesis is corroborated by neurophysiological evidence. Watching sexually attractive stimuli elicits neuronal activities in brain areas commonly associated with the human reward system (e.g., Ishai, 2007; Karama et al., 2002; Mouras et al., 2003; Ponseti et al., 2006; Redouté et al., 2000; Safron et al., 2007; Stoléru et al., 1999). Humans are assumed to be motivated by hedonism (e.g., Epstein, 1990) in that they try to reach and maintain positive affective states. Singer (1984) argued that it is the "hedonic feeling in response to a sexual stimulus" (p. 233) that motivates the individual to keep the sexually attractive object in view. In addition, even in the absence of stimuli, participants might be motivated to delay responding to prolong rewarding reminiscence of the stimuli or sexual fantasies. In short, viewing time effects could result from the controlled and intentional delay to keep a sexually pleasant stimulus in view or keep a sexually pleasant internal representation.

Attentional Adhesion to Sexual Stimuli

Second, the delayed responding could be mediated by the automatic process of attention direction toward presented sexually attractive stimuli. It can be argued that sexually attractive stimuli automatically bind attention and distract participants from their actual task to rate the persons' sexual attractiveness. Responses are, therefore, delayed. A very similar assumption underlies the rationale of the CRT (Santtila et al., in press; Wright & Adams, 1994) and recent research suggests that sexual arousal can indeed increase attentional adhesion to attractive

opposite-sex targets (Maner, Gailliot, Rouby, & Miller, 2007). Although deliberate delay and attentional adhesion are clearly distinct, they have not been well differentiated in the literature so far. It should be noted that both explanations are not mutually exclusive. It is conceivable that sexually attractive stimuli could automatically attract and bind attention; the visual processing could then elicit positive affect, which subsequently causes deliberate prolonged viewing and a delayed judgment to maintain the pleasurable state.

Sexual Content Induced Delay (SCID)

In the literature on Sexual Content-Induced Delay (SCID; Geer & Bellard, 1996; Geer & Melton, 1997), it has been found that the presentation of erotic stimuli induces hesitancy in decision making. Spiering, Everaerd, and Elzinga (2002) provided data to support their interpretation of SCID as an evolutionary adaptive activation of conscious regulation modules. To the degree that stimuli presented in viewing time tasks are sexually explicit (as compared to neutral or mildly erotic; Spiering, Everaerd, & Laan, 2004) viewing time effects may be a special case of the general SCID phenomenon.

Mate Identification

A fourth class of explanations postulates internal processes that are automatically triggered by either sexually attractive stimuli as such or the specific task to rate their sexual attractiveness. Briefly presented stimuli could trigger internal attentional processes to erotic cues as well as expectancies and/or schematic concepts (Wiegel, Scepkowski, & Barlow, 2007). Finally, the effect could also emerge as a result of the task commonly connected to viewing time measures. It is conceivable that denying sexual attractiveness on average is faster than confirming it and responses for sexually attractive stimuli are thus prolonged.

The Present Research

As we have seen so far, there are at least four plausible explanations for prolonged response latencies of sexually attractive stimuli. However, to the best of our knowledge, these plausible explanations have never been empirically tested, and it was the aim of the present research to start to close this gap. The deliberate delay hypothesis can be tested by constraining the viewing conditions of sexually attractive targets in a way that it becomes unlikely that the observed latencies are caused by a controlled delay. If the deliberate delay hypothesis is true, prolonged viewing of sexually attractive targets should be reduced or eliminated if the response can only be given in the absence of the hedonically rewarding stimulus (i.e., after the stimulus has disappeared). Likewise, attentional adhesion necessarily requires the presence of the stimulus and should be eliminated in its absence. The first two experiments tested the effect of stimulus presence on viewing time effects and provide first evidence that these effects also emerge in the absence of stimuli. To further elucidate the nature of the underlying process we tested the boundary conditions of the viewing time effect in Experiments 3 and 4 by drastically reducing the time frame in which a response can be given and by presenting only the heads of the target stimuli (Experiment 4).

Experiment 1

Prolonged response latencies for sexually attractive stimuli due to deliberate delay crucially depend on the presence of the sexually attractive stimuli. If the sexually attractive stimuli are removed before participants give their attractiveness rating, there is no longer a reason to deliberately delay the attractiveness rating because it will not prolong the time participants can watch the stimuli. Furthermore, an absent stimulus is unlikely to hold attention and distract from the actual rating task. To test these predictions, the presentation time of target stimuli was experimentally manipulated in Experiment 1. To the extent that prolonged RTs for

sexually attractive targets are caused by deliberate delay or attentional adhesion to the stimulus, prolonged RTs for sexually preferred targets were expected in the standard viewing time task, but these should vanish under restricted presentation conditions. To the extent that internal processes cause delayed responding to sexually attractive stimuli these should occur even in the absence of stimuli. Heterosexual and homosexual men were recruited as groups with contrasting sexual preferences that are not confounded by sex differences in response to visual sexual stimuli (Rupp & Wallen, 2008).

METHOD

Participants

A sample of 35 heterosexual and 24 homosexual men was recruited by posters and via online forums for a study on attractiveness. Participants were informed that the experiment would entail direct and indirect measures of their sexual interest in men, women, boys, and girls. Participants were further informed that they could withdraw from the experiment at any time without disadvantage, and that all data were collected and stored in fully anonymous form. Written consent was obtained prior to the experiment. Participants received 5 Euro for participation. The mean age of participants was 24.8 years. Their age was independent of sexual orientation, $t(57) = 1.52$. Sexual orientation was checked by an Explicit Sexual Interest Questionnaire (ESIQ; Banse et al., in press). Out of 10 possible sexual behaviors or fantasies regarding women, heterosexual men reported an average of $M = 9.8$, $SD = .47$, whereas homosexual men reported $M = 1.5$, $SD = 1.10$. For sexual behaviors and fantasies regarding men, this pattern reversed: heterosexual men reported an average of $M = 0.4$, $SD = .92$ and homosexuals an average of $M = 9.8$ ($SD = .41$).

Stimuli and Materials

The target stimuli were 40 computer-constructed photographs of male and female individuals taken from the Not Real People (NRP) picture Set (Subset B, Pacific Psychological Assessment Corporation, 2004; for examples, see Laws & Gress, 2004), featuring male and female individuals belonging to five categories of sexual maturation (corresponding to Tanner, 1978). The Tanner categories 1 to 3 depict pictures of prepubescent children of increasing maturity, Tanner category 4 adolescents, and Tanner category 5 young adults. All individuals were shown in bathing clothes of different colors.

Viewing Time Measure

The subset of 40 target pictures was divided into two halves with two target individuals per age x sex combination. The assignment of these two sets to the experimental conditions was counterbalanced. In the first experimental condition (the standard viewing time procedure), target pictures and a rating scale (1 = “sexually not attractive” to 5 = “sexually very attractive”) were presented simultaneously. Both the picture and the scale were presented until the response was given and confirmed by pressing the enter key. In the second condition (the restricted condition), the target picture was presented for 750 ms, followed by the response scale. The response scale remained visible on the screen until a response was entered and confirmed. The response time (RT) in the attractiveness rating task served as the dependent variable. Recording of RT started with the presentation of the Likert scale.

Procedure

Upon their arrival in the laboratory, participants were informed about the aims and procedures of the experiment. After giving their informed consent, four different indirect assessment tasks were performed in the following order: a Sexual Misattribution Procedure (Imhoff, Banse, Schmidt, & Bernhardt, 2009), the viewing time task, an Implicit Association

Test, and a Choice Reaction Task. Only the viewing time task was of interest here, so the results of the other measures will not be reported in this article. At the end of the experiment, participants completed a sexual preferences questionnaire, and were then debriefed, paid for their participation, and thanked.

Design

The factorial design was a 2 (Participant Sexual Orientation: Heterosexual vs. Homosexual) x 2 (Target Sex: Male vs. Female) x 5 (Target Age: Tanner Categories 1-5) x 2 (Display Condition: Standard vs. Restricted), with one between-subjects factor and three within-subjects factors.

RESULTS

The response latencies for each of the 2 x 5 target categories were averaged. A 2 (Participants' Sexual Orientation) x 2 (Target Sex) x 5 (Target Age) x 2 (Display Condition) repeated measures analysis of variance (ANOVA) revealed that a viewing time effect emerged, as indicated by a significant three-way Participants' Sexual Orientation x Target Age x Target Sex interaction, $F(4, 54) = 10.46$, $p < .001$, $\eta_p^2 = .44$. Figure 1 shows the mean latencies as a function of Participants' Sexual Orientation, Target Sex and Target Age for both display conditions separately. Means show that adults generally elicited the longest RTs, $F(4, 54) = 29.27$, $p < .001$, $\eta_p^2 = .68$, but that this effect was more pronounced for the preferred sex (Participant Sexual Orientation x Target Sex). However, contrary to the predictions derived from the deliberate delay and attentional adhesion hypotheses, this effect was independent of display condition as indicated by the non-significant four-way interaction, $F(4, 54) = 1.03$.

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insert Figure 1 here

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Table I shows the results in a condensed design of only two target age categories: prepubescent (Tanner 1-3) vs. postpubescent (Tanner 4-5). Both homosexual and heterosexual men showed the longest RTs for postpubescent stimuli of the preferred sex and the shortest RTs for prepubescent stimuli of the non-preferred sex. Standardized preference scores for postpubescent males over females almost perfectly predicted participants' sexual orientation in a ROC analysis, AUC = .95, $p < .001$.

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DISCUSSION

The results of Experiment 1 showed that sexually more attractive targets elicited longer response latencies than sexually less attractive targets in a rating task of sexual attractiveness by homosexual and heterosexual men. Contrary to the prediction derived from the deliberate delay or attentional adhesion accounts, this effect was obtained not only for the standard viewing time condition, but also under conditions of restricted stimulus display. Although the stimuli were presented for only 750 ms, and the judgment of sexual attractiveness was performed after the target picture had disappeared, prolonged latencies for sexually preferred stimuli emerged. Additionally, neither effect sizes nor the criterion validity of measures showed any substantial difference between the standard and restricted presentation conditions. Thus, Experiment 1 did not support the claim that prolonged viewing time effects under conditions of restricted stimulus display can be explained by a deliberate delay of the response to keep a sexual stimulus in view or an attentional adhesion to a sexually attractive stimulus. This result raises the question of

whether the label “Viewing Time” for the observed effect is a misnomer. In fact, participants under restricted conditions viewed all stimuli for the same amount of time but still differed in their latencies. The effects could thus be better described as prolonged response latencies for sexually attractive targets (PRELSAT).

It could be argued, however, that even in the absence of the stimulus pictures participants may experience afterimages of the targets on their retina. Thus, it cannot be excluded that this (retinal) afterimage was distracting and/or rewarding and therefore responsible for the effect in the restricted condition. In order to eliminate this possibility, a second experiment was conducted in which target pictures were displayed for an even shorter time of 500 ms, and then masked before the rating could be given. For Experiment 2, we chose heterosexual men and women as a sample. Recent research suggests that women are generally less specific in their sexual response than men, showing subjective and genital sexual arousal to pictures of both men and women (Chivers, Rieger, Latty, & Bailey, 2004; Chivers, Seto, & Blanchard, 2007). However, prior research on the viewing time effect has provided mixed results. Although standard viewing time effects emerged also for women, these effects were usually smaller than those for heterosexual males (Israel & Strassberg, 2009; Quinsey et al., 1996). To explore this gender specificity effect also for the restricted display variation, we recruited a community sample of men and women. By excluding not clearly heterosexual individuals, we created groups in which participant sex served as a proxy for contrasting sexual preferences.

Experiment 2

The setup of Experiment 2 was similar to Experiment 1, except that the number of trials was increased and the target stimuli were presented for 500 ms. Most importantly, target stimuli were immediately followed by a pattern mask to overwrite any afterimages on the retina. With

regard to the sample, heterosexual men and women were selected as known groups with contrasting sexual preference.

METHOD

Participants

The sample consisted of 69 participants (33 men, 36 women) with a mean age of 26.2 years, and contrasting sexual preferences (sexual interest in men: $M = 0.7$, $SD = 1.32$, for males and $M = 9.4$, $SD = .83$, for females; sexual interest in women $M = 9.7$, $SD = .74$, for men and $M = 1.9$, $SD = 1.78$, for women). Participants were informed that the study investigated sexual interest towards children and adults of both sexes and written consent was obtained.

Stimuli and Materials

As compared to Experiment 1, the number of trials was doubled to 40 in each condition to achieve an even more reliable measure. In the restricted condition, presentation time was further reduced to 500 ms, followed by a pattern mask that was displayed for 250 ms.

Procedure

After the viewing-time task, participants completed the ESIQ as an explicit measure of sexual preference, were debriefed, and thanked.

RESULTS

A 2 (Participant Sex) x 2 (Target Sex) x 5 (Target Age) x 2 (Display Condition) repeated measures ANOVA was calculated. As in Experiment 1, the PRELSAT effect emerged independently of display condition. The interaction of Participant Sex x Target Age x Target Sex was significant, $F(4, 64) = 6.77$, $p < .001$, $\eta_p^2 = .30$, and was not qualified by a four-way interaction with display condition, $F < 1$. A general increase of latencies with increasing target age was stronger for targets of the preferred sex (Fig. 2). Whereas heterosexual men showed a

specific pattern of longer RTs in both display conditions, heterosexual women showed a non-specific pattern of increased RTs for both male and female postpubescents (Table I). The criterion validity was thus not as high as in Experiment 1, but still substantial and significant in the standard condition, AUC = .80, $p < .001$, as well as in the restricted condition, AUC = .86, $p < .001$.

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DISCUSSION

Replicating Experiment 1, the results provided evidence that the PRELSAT effect did not vanish under even more restricted conditions. Masking the stimuli before presenting the scale ruled out an explanation based on afterimage effects. Thus, stimulus visibility was not required to produce PRELSAT effects.

An inspection of the absolute latencies suggests that, despite identical patterns, in the standard viewing time condition it took participants roughly twice as long to rate the sexual attractiveness of the presented stimuli as in the restricted condition. This difference can be partially explained by the time to actually see and perceive the stimuli that were included in the RT under standard conditions, but not under restricted conditions. However, it seems plausible that, in the absence of any time pressure, participants spontaneously engaged in behavior induced by sexually attractive stimuli. For example, they might engage in processes of social comparisons--checking the physique of the stimulus as compared to their own or their partners. In fact, they may have enjoyed watching sexually attractive stimuli and thus deliberately delayed their response. However, the results of the two experiments provided evidence that the prolonged

response latencies did not depend on such a mechanism. Furthermore, by allowing participants to take more time, it seems likely that while potentially tapping into this hedonic pleasure effect, additionally more noise was recorded that blurred the measure.

Having established the fact that processes independent of stimulus presence were sufficient to produce PRELSAT effects, we were interested in further narrowing down the plausible explanations. It is conceivable that deliberate delay is not motivated by watching visually pleasant stimuli but rather by an internal reminiscence initially activated by such a stimulus (Wiegel et al., 2007). Hence, constraining the sensory input does not preclude the possibility that the pictures of sexually attractive targets elicit sexual thoughts, fantasies, and/or expectancies that are pleasurable and thus are maintained before responding to the task. Therefore, a third experiment was conducted to restrict the participants` behavior after exposure to sexually attractive stimuli. This was achieved by changing the nature of the task from an evaluation task to a speeded performance measure.

Experiment 3

In an attempt to constrain fantasizing and imagery following the presentation of targets, the self-paced evaluation of sexual attractiveness was replaced by a simple binary decision task in which participants had to decide whether a target person was either a “potential sexual partner” or “not a potential sexual partner” for them. Participants were instructed to make their decision as fast as possible within 1000 ms. The speeded task should eliminate deliberative processes leading to deliberately delayed responding.

METHOD

Participants

The sample consisted of 58 heterosexual participants (29 men, 29 women), after excluding two bisexual participants on base of their ESIQ scores. The mean age was 29.0 years, and there was no significant age difference between men and women, $t(56) < 1$. All participants gave their informed, written consent to participate in a study on sexual preferences.

Procedure

For the speeded viewing-time trials, participants were asked to classify as quickly as possible the randomly presented targets by pressing the left (no potential sexual partner) or the right response button (potential sexual partner). Participants then completed a filler task, the standard viewing time procedure, and the ESIQ before taking again the same speeded response task to assess the stability of the measure.

Stimuli and Materials

The standard viewing time condition was identical to the one in Experiment 2. In the speeded condition, both categories were anchored in black letters next to the top right and left corner of the picture, respectively. After exceeding a response time of 1000 ms, an error message "too slow!" appeared above the picture stimulus.

Design and Specific Hypotheses

The experiment followed a 2 (Participant Sex) x 2 (Target Sex) x 5 (Target Age) x 3 (Response Condition: Standard vs. Speeded 1 vs. Speeded 2) mixed factorial design with one between-subjects factor and three within-subjects factors. Under standard viewing conditions, we expected prolonged RTs for sexually preferred targets. Female participants were expected to show the longest RTs for adult male targets, whereas male participants were expected to show the longest reaction times for adult female targets. Under conditions of speeded responding, deliberate delay due to internal reminiscence should be strongly reduced or eliminated, and thus

prolonged RTs for sexually preferred targets under speeded condition would suggest a different process.

RESULTS

For the speeded response measures, all trials with RTs greater than 1000 ms were defined as errors and discarded. One participant's results were excluded from the analysis of the second speeded response task as his error rate was more than 2 SD above the mean.

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A 2 (Participant Sex) x 2 (Target Sex) x 5 (Target Age) x 3 (Response Condition) ANOVA yielded a three-way Participant Sex x Target Sex x Target Age interaction, $F(4, 52) = 23.31$, $p < .001$, $\eta_p^2 = .62$. Contrary to Experiments 1 and 2, it was qualified by a significant four-way interaction with response condition, $F(8, 48) = 8.94$, $p < .001$, $\eta_p^2 = .60$, indicating that the size and/or direction of the three-way interaction depended on response condition. Separate analyses of all three conditions showed this was due to the fact that the hypothesized three-way interaction was significant and comparable for all three conditions but more pronounced in the second speeded condition. In the second speeded condition, the effect was somewhat larger, $F(4, 52) = 36.91$, $p < .001$, $\eta_p^2 = .74$, than in the standard viewing time procedure, $F(4, 53) = 16.85$, $p < .001$, $\eta_p^2 = .56$, and the first speeded procedure, $F(4, 52) = 13.71$, $p < .001$, $\eta_p^2 = .51$. Figure 3 shows comparable and hypothesized patterns of the means for all three conditions: longer RTs for older targets were stronger for the preferred sex. In contrast to Experiment 2, in all three measures heterosexual women showed an effect of target sex for postpubescent stimuli (Table II).

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The psychometric quality of the speeded response measure can be inferred from an AUC between .98 and 1.00, resulting in correct classifications of up to 97% of the participants as well as a retest reliability of r_{tt} = .86, p < .001, for the standardized difference score for postpubescent stimuli.

DISCUSSION

The results of Experiment 3 provided evidence that the effect of prolonged RT for sexually preferred targets persisted even under conditions of a speeded binary response task. This result rules out deliberative reminiscence as the cause of prolonged RTs. The speeded response conditions essentially yielded the same results as the standard condition, the effect sizes were even somewhat larger, and the classifications as correct as in the standard viewing time condition. It seems plausible that performance under time pressure might be a clearer reflection of the automatic process underlying implicit sexual preference. The large effect sizes, together with the more automatic nature and the fully satisfactory retest reliability, may make this paradigm an attractive alternative to the standard viewing time procedure for diagnostic purposes. Finally, to further narrow down plausible explanations of PRELSAT effects, we reduced the potential erotic content of stimuli Experiment 4.

Experiment 4

In the SCID literature, it has been reported that these delay effects appear only after presenting sexually explicit content (pornographic images), whereas no SCID was found after presenting mere erotic images or pictures of nude models (Spiering et al., 2004). Most viewing

time research relies on portrayal of nude or only partly clothed persons, sometimes displaying the genital area (Harris et al., 1996; for the use of nude stimuli, see Brown, Amoroso, Ware, Pruesse, & Pilkey, 1973; Love, Sloan, & Schmidt, 1976; Quinsey et al., 1996; Ware, Brown, Amoroso, Pilkey, & Pruesse, 1972). In these experiments, PRELSAT effects could be considered a special case of a more general SCID Effect.

In Experiments 1 to 3, the target persons were clothed in bathing suits. Although unlikely to produce the same effect as explicit sexual imagery, particularly for participants with a corresponding sexual preference, men wearing tight swimming trunks and women wearing bikinis might function as mildly sexually arousing stimuli. To investigate whether this (mildly) erotic content is a necessary condition to produce the PRELSAT effect, heads-only pictures were edited from the full body pictures used in the previous experiments. If the PRELSAT effect is merely a specification of the SCID effect, no latency differences between sexually preferred and non-preferred targets should be expected.

METHOD

Participants

A total of 28 female (sexual interest in men $M = 9.2$, $SD = .94$ and women $M = 1.8$, $SD = 1.57$) and 36 male (sexual interest in men $M = 0.7$, $SD = 1.37$ and women $M = 9.3$, $SD = 1.23$) heterosexual participants were, on average, 25.6 years old, independent of sex, $t(62) = 1.32$. They gave their informed consent for participating in a study that dealt with sexual attractiveness of faces.

Procedure

After completing the speeded response procedure, participants completed the ESIQ as a manipulation check, were debriefed, and thanked.

Stimuli and Materials

The 80 items pictures used as items before were digitally cropped to show only the heads of the target individuals. Except for that, the speeded response task was similar to the speeded variations used in Experiment 3.

Design

The design was the same as used for the different response conditions in Experiment 3.

RESULTS

As in Experiment 3, only trials with RTs below 1000 ms were used for data analysis. A 2 (Participant Sex) x 2 (Target sex) x 5 (Target age) repeated measures ANOVA was conducted. Contrary to the SCID hypothesis, the Participant Sex x Target Sex x Target Age three-way-interaction was significant, $F(4, 59) = 13.62$, $p < .001$, $\eta_p^2 = .48$. As illustrated in Fig. 4, and as in Experiments 1 to 3, a linear effect of target age was most pronounced for stimuli of the preferred sex. Both heterosexual men and women showed the longest latencies for postpubescent targets of the preferred sex, resulting in a high criterion validity of the standardized difference measure, AUC = .96, p < .001 (Table II).

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DISCUSSION

Participants showed longer RTs to rate members of a sexually preferred category as a potential sexual partner compared to non-preferred target categories. This pattern emerged under the time pressure of a response window of 1000 ms and in the absence of any primary most

secondary sexual characteristics, as only heads of targets were presented. Thus, it is unlikely that sexually arousing content and resulting SCID was responsible for the effect replicated here.

GENERAL DISCUSSION

Across four experiments, the present study provided consistent evidence that participants showed prolonged response latencies for rating the sexual attractiveness of targets belonging to the sexually preferred category even under conditions of strongly restricted stimulus presentation and speeded responding. Prolonged response latencies emerged (1) in the absence of target pictures (Experiments 1 and 2), (2) under speeded responding (Experiments 3 and 4) and (3) with target stimuli devoid of any primary or secondary sexual characteristics (Experiment 4). A comparison between the psychometric properties of the standard viewing time and restricted presentation or speeded response conditions generally indicated somewhat improved performance under the restricted conditions.

The findings shed light on the processes underlying the PRELSAT effect. Four plausible explanations were introduced. Deliberate delay to keep a stimulus in view as well as attentional adhesion both require the presence of the stimulus, as is the case in standard viewing time procedures. The results of the present study challenge these explanations. If the PRELSAT effect is based on deliberate watching of arousing stimuli and intentional delay of the response, it should be strongly reduced under restricted conditions, i.e., in the absence of the stimuli, under time pressure, or if no sexually arousing stimuli (faces) are used. A deliberate delay of the response due to hedonically rewarding internal images, scripts or schemas connected to sexual content was ruled out by drastically reducing the response window to 1000 ms. However, across all four experiments, the effect of prolonged response latencies for sexually preferred stimuli

remained stable and large, and correctly discriminated between participant groups according to their sexual preference.

If it is the case that a sexually attractive stimulus differentially *distracts attention* from the rating task, the effect should be strongly reduced in the absence of stimuli. The attentional adhesion hypothesis is, therefore, difficult to reconcile with the results of restricted stimulus presentation conditions in Experiments 1 and 2, unless one ascribes an attention-grabbing power to an absent stimulus. PRELSAT effects emerged even in the absence of stimuli, leaving some kind of (highly automatic) internal processes resulting from either the brief presentation of sexual stimuli or the specific task to rate sexual attractiveness as the only remaining explanation. SCID, i.e., hesitancy in decision making after priming with sexually explicit images, was ruled out in Experiment 4 by using stimuli devoid of any primary or secondary sexual characteristics. Thus, findings from the four experiments suggest that the underlying process functions rather quickly, and also in the absence of stimuli. These are most likely processes of mate identification and potentially resulting schematic processes. We propose two processes that can be reconciled with the results.

Task-Specific Cognitive Processing

It is conceivable that PRELSAT effects are based on cognitive processes resulting from the identification of potential sexual partners, i.e., structural demands of the task. Rating the sexual attractiveness or acceptability of a sexual partner requires one to correctly classify the stimulus regarding age and sex before judging the attractiveness. For a positive answer, a heterosexual man first has to confirm that the target person is a woman, i.e., has the appropriate sex (female) and age (post puberty). Thus, to reach a decision regarding the sexual attractiveness or suitability of the target as a sexual partner, participants need to integrate the three criteria of sex, age, and

attractiveness. Participants may test these criteria sequentially ("Is this person at an age appropriate for sexual attractiveness?"; "Is this person of the sex I find attractive?"; "Are the physical features sexually attractive to me?"). The process can be stopped as soon as one feature check results in a negative response. Thus, for all non-preferred targets, a negative outcome of any of the three checks is sufficient to give a low sexual attractiveness score or to reach the decision "no potential sexual partner." Conversely, as long as the outcome of sequential checks is positive, it is necessary to continue target scrutiny until all three criteria are evaluated. Such a sequential processing can account for longer response latencies for sexually attractive targets, as positive identification of sexual mates always require the evaluation of all three criteria, whereas negative decisions require the evaluation of one, two, or three criteria. As the actual decisions participants made in Experiments 3 and 4 showed that not all preferred adults were identified as potential sexual partners (roughly 50-80%), participants had apparently also evaluated the individual attractiveness of targets.

Stimulus-Specific Schematic Processing

Sexually preferred stimuli can only have an effect after they are identified as such. However, as an alternative to the mere identification process, prolonged latencies could also follow from internal processes automatically triggered by the identification of an object as a potential sexual partner. In fact, the previous literature suggested that the underlying processes of viewing time effects are "attentional" (e.g., Kalmus & Beech, 2005), implying processes elicited by sexually attractive stimuli, not by the task. Although attentional adhesion to present stimuli was ruled out as an explanation in Experiments 1 and 2, automatic attention could be directed toward internal representation (e.g., sexual fantasies, scripts, or schemata).

Age Effects for Individuals of the Non-Preferred Sex

These two plausible accounts are both reconcilable with the observed pattern of increasing response latencies, even for adults of the non-preferred sex. However, both accounts would imply two different explanations. From a mere identification perspective, we would expect a target age effect also for the non-preferred target sex (i.e., heterosexual men should be faster to discard male children than adult men), if target age can be identified faster than target sex. Such a main effect of target age for the non-preferred sex is exactly what we find almost across all experiments (for a similar effect for male participants, see Quinsey et al., 1996). From a perspective of schematic processing, such an effect could be explained if adults of the non-preferred sex are more associated with the concept of sexuality and related schemata than children (i.e., the concept of sexuality in heterosexual men is less associated with male children than adult men).

Based on our data neither of the two processes–task-specific processing or stimulus-specific processing–can be ruled out. Future research will have to separate task from stimulus effects to empirically test these two accounts. This was beyond the scope of the present study.

Speeded Response Variant

The present research has replicated that sexually preferred targets elicit longer latencies than non-preferred targets under unrestricted conditions. Contrary to predictions derived from two plausible hypotheses regarding the underlying processes (deliberate delay and attentional adhesion), prolonged response latencies for sexually preferred targets were not reduced under conditions of restricted stimulus presentation or speeded responding. We therefore argue that, at least under these restricted conditions, other processes cause prolonged response latencies for sexually preferred targets. The presumed cognitive processes that cause differential effects for sexually preferred and non-preferred targets take place within approximately 700 ms after the

presentation of target stimuli. Both above-mentioned processes might be involved in causing prolonged reaction latencies between 700 ms and the typical latency of up to 5000 or 6000 ms in the standard viewing time paradigm. However, the effect sizes and the criterion validity in the standard version were not superior to the restricted versions. It thus appears that the proportion of viewing time variance that is a valid indicator of sexual preference is rather confined to the early phases of processing. The variance due to latencies beyond 700 ms seems to be largely blurred by noise and non-specific behavior that does not add to the diagnostic value of viewing time. Although our results cannot rule out that deliberate delay did indeed lead to an increase in latencies under standard conditions (which would imply different mechanisms involved in the different variations), the data suggest that this additional time due to delay does not turn Viewing Time into a more valid measure.

This reasoning implies that speeded variants of the viewing time paradigm may be preferable to the standard viewing time measure. Time constraints turn the task into a performance measure that is generally more likely to tap into automatic processes. These may be harder to control and thus less prone to faking compared to controlled processes. Although indirect measures are generally assumed to be more immune to faking than self-reports, PPG has been widely criticized for being liable to deliberate faking by suppression of an erection (Kalmus & Beech, 2005; Konopansky & Konopansky, 2000), most successfully by cognitive deflection. Despite the fact that viewing time measures have been shown to successfully detect even socially sanctioned sexual interest, it has to be established empirically to what extent speeded and standard viewing time procedures are robust against faking.

Female Non-Specificity

Our results also shed some light on the intriguing questions of sex differences in gender specificity of sexual arousal. Previous studies have shown that women generally show less specific reactions to male stimuli compared to female stimuli than men do. Our findings confirm this general pattern in Experiment 2 (women showed no specificity at all) and in Experiment 3 (women showed less specificity than men). When the stimuli were reduced to heads (Experiment 4), this difference vanished and women's latencies differed between male and female stimuli to the same degree as men's. Whether this is an effect of the stimulus reduction or a characteristic of the specific sample is open to future research.

The present study has also shown that faces are sufficient to elicit prolonged response latencies for sexually preferred targets. This result might be particularly important for forensic contexts where it is highly desirable to use non-erotic content for the assessment of deviant sexual preference, for ethical as well as legal reasons (Abel, Jordan, Hand, Holland, & Phipps, 2001). Future research will have to provide evidence as to whether the restricted and reduced viewing time variants introduced in this study are suitable also for forensic samples (e.g., that pedophiles show longer latencies for faces of children).

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Table I

Criterion validity and mean latencies (ms) as a function of stimulus maturity (prepubescent vs. postpubescent) and stimulus sex (male vs. female) for standard viewing time and restricted display procedures with hetero- and homosexual men (Experiment 1) and heterosexual men and women (Experiment 2)

	Female stimuli				Male Stimuli				Effect Size	Criterion Validity	
	prepubescent		postpubescent		prepubescent		postpubescent				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*d*	*AUC*	Correct Classifications
Experiment 1: Standard Viewing Time											
Heterosexual Men (n = 35)	2429^{ab}	1150	4353^{c}	1614	2199^{a}	1004	2814^{b}	1523	1.09	.95	85.7 %
Homosexual Men (n = 24)	2052^{a}	890	3085^{b}	1401	3007^{b}	1769	4711^{c}	1907	-0.86		83.3 %
Experiment 1: Restricted Display											
Heterosexual Men (n = 35)	1464^{a}	616	2469^{b}	986	1405^{a}	612	1511^{a}	587	1.00	.96	85.7 %
Homosexual Men (n = 24)	1358^{a}	599	1753^{b}	907	1922^{b}	1208	2592^{c}	1016	-0.83		79.2 %
Experiment 2: Standard Viewing Time											
Heterosexual Men (n = 33)	1934^{ab}	683	3737^{c}	1676	1891^{a}	770	2385^{b}	1596	0.62	.80	63.6 %
Heterosexual Women (n = 36)	1812^{a}	547	2954^{b}	1492	1839^{a}	436	2838^{b}	1015	-0.17		72.2 %
Experiment 2: Restricted Display											
Heterosexual Men (n = 33)	1181^{a}	288	2063^{b}	985	1323^{a}	585	1532^{a}	697	0.53	.86	78.8 %
Heterosexual Women (n = 36)	1256^{A}	296	1617^{B}	567	1263^{A}	315	1795^{B}	582	-0.25		77.8 %

Note. Different index letters in one row indicate significant differences in simple tests (Bonferroni-corrected α = .008). Effect sizes for the different latencies are based on male vs. female postpubescent stimuli. All predictions are based on difference scores (male vs. female postpubescent stimuli), $p < .001$.

Table II

Criterion validity and mean latencies (ms) as a function of stimulus maturity (prepubescent vs. postpubescent) and stimulus sex (male vs. female) for standard viewing time and speeded response procedures with heterosexual men and women in Experiments 3 and 4

	Female stimuli				Male Stimuli				Effect Size	Criterion Validity	
	prepubescent		postpubescent		prepubescent		postpubescent				
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*d*	*AUC*	Correct Classifications
Experiment 3: Standard Viewing Time											
Heterosexual Men (n = 29)	1370[a]	733	3038[b]	1348	1239[a]	576	1425[a]	848	1.26	.96	93.1 %
Heterosexual Women (n = 29)	1086[a]	276	1772[b]	745	1101[a]	260	2164[c]	568	-0.62		93.1 %
Experiment 3: Speeded Response 1											
Heterosexual Men (n = 29)	572[a]	105	701[c]	105	531[b]	108	579[a]	89	1.69	.98	93.1 %
Heterosexual Women (n = 29)	502[a]	79	558[c]	98	519[b]	83	640[d]	68	-1.13		89.7 %
Experiment 3: Speeded Response 2											
Heterosexual Men (n = 28)	481[b]	92	612[c]	90	437[a]	83	465[b]	95	2.35	1.00	96.4 %
Heterosexual Women (n = 29)	420[a]	63	463[b]	99	433[ab]	58	555[c]	68	-1.36		96.6 %
Experiment 4: Speeded Response											
Heterosexual Men (n = 36)	513[b]	92	583[c]	88	471[a]	93	515[b]	103	1.04	.96	97.2 %
Heterosexual Women (n = 28)	450[a]	86	475[b]	105	476[b]	94	569[c]	94	-1.13		89.3 %

Note. Different index letters in one row indicate significant differences in simple tests (Bonferroni-corrected $\alpha = .008$). Effect sizes for the different latencies are based on male vs. female postpubescent stimuli. All predictions are based on difference scores (male vs. female postpubescent stimuli), $p < .001$.

Figure Captions

Figure 1. Viewing-time (ms) as a function of Target Age (Tanner Category) and Target Sex (female vs. male) for hetero- and homosexual male participants in an unrestricted standard viewing time (Panel A) and a restricted display task (stimulus presentation 750 ms; PANEL B) in Experiment 1. Effect sizes for linear within-subject contrasts for Target Age, $^{**}p < .01$, $^{*}p < .05$.

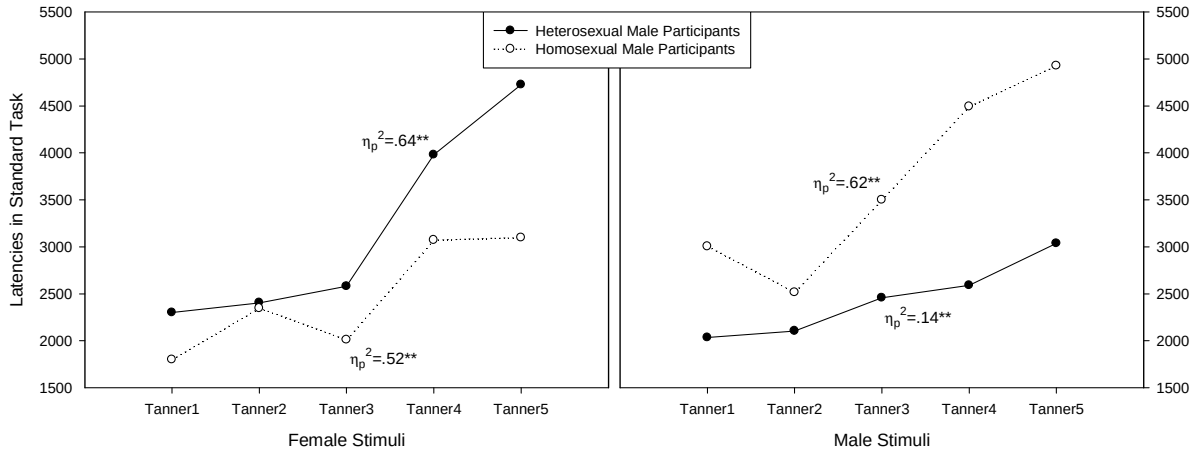
Figure 2. Viewing-time (ms) as a function of Target Age (Tanner Category) and Target Sex (female vs. male) for heterosexual men and women in an unrestricted standard viewing time (Panel A) and a restricted display task (stimulus presentation 500 ms, masked; Panel B) in Experiment 2. Effect sizes for linear within-subject contrasts for Target Age, $^{**}p < .01$, $^{*}p < .05$.

Figure 3. Viewing-time (ms) as a function of Target Age (Tanner Category) and Target Sex (female vs. male) for male and female heterosexual participants in standard viewing time (Panel A) and two speeded response tasks (1000ms response window, two assessments; Panel B and C) in Experiment 3. Effect sizes for linear within-subject contrasts for Target Age, $^{**}p < .01$, $^{*}p < .05$.

Figure 4. Viewing-time (ms) as a function of Target Age (Tanner Category) and Target Sex (female vs. male) for male and female heterosexual participants in a speeded response task with portrait pictures in Experiment 4. Effect sizes for linear within-subject contrasts for Target Age, $^{**}p < .01$, $^{*}p < .05$.

Figure 1

Panel A



Panel B

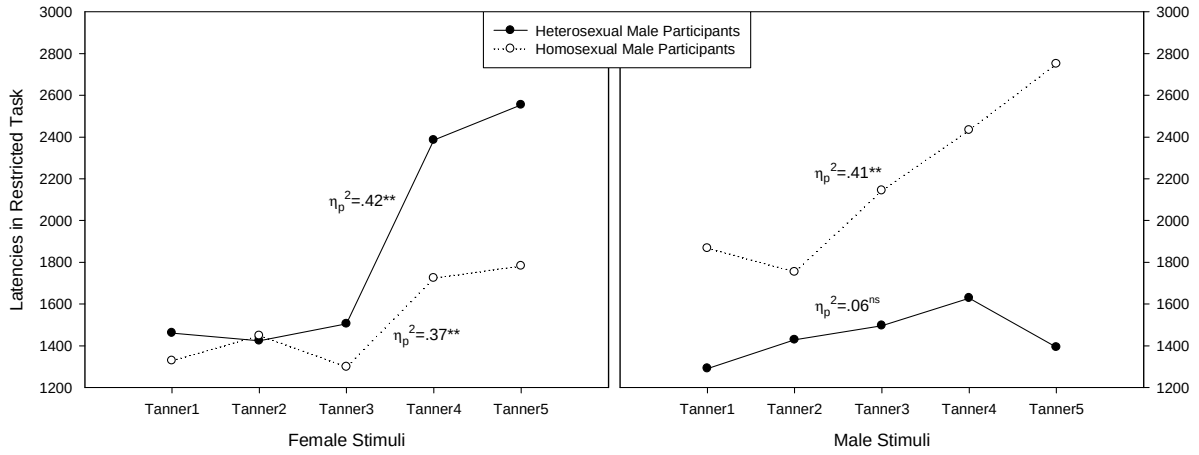
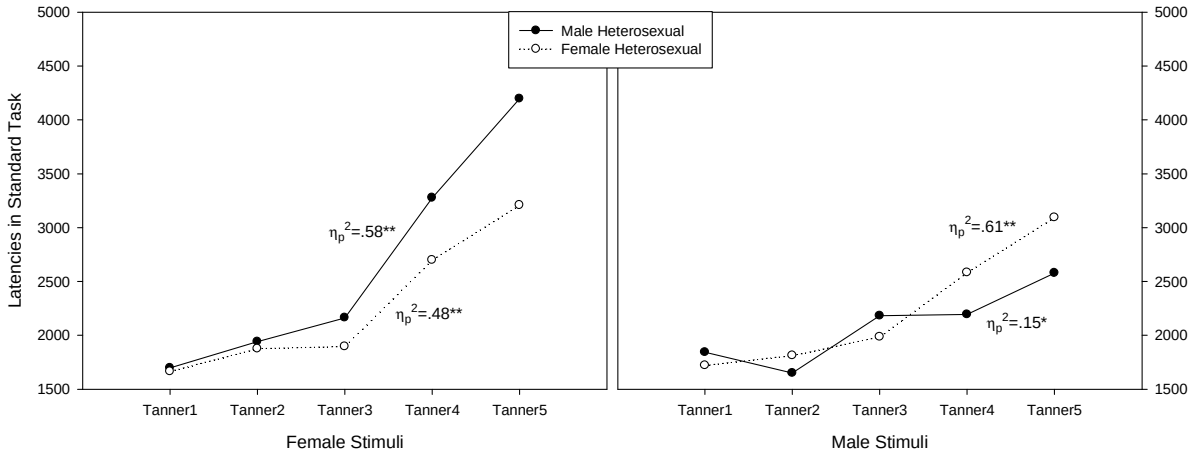


Figure 2

Panel A



Panel B

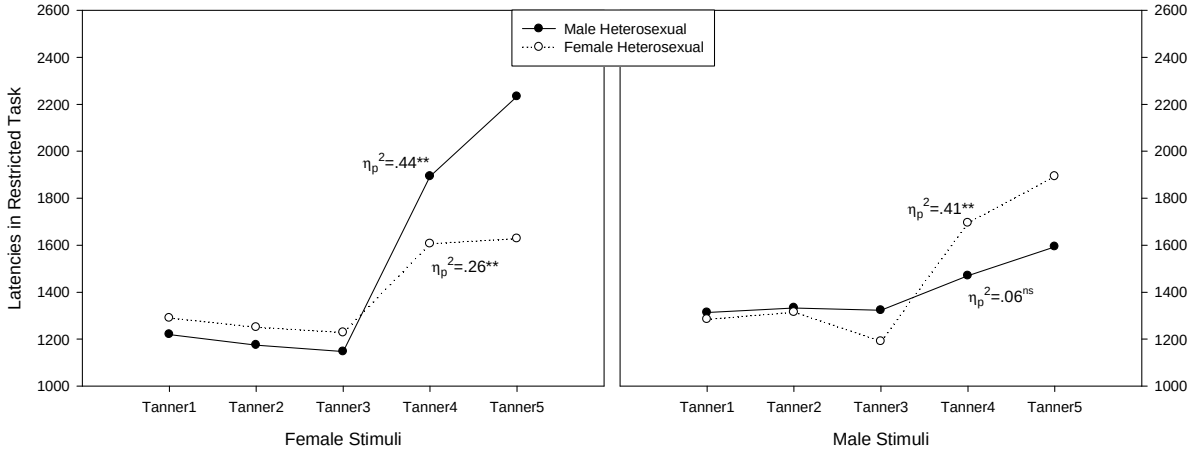
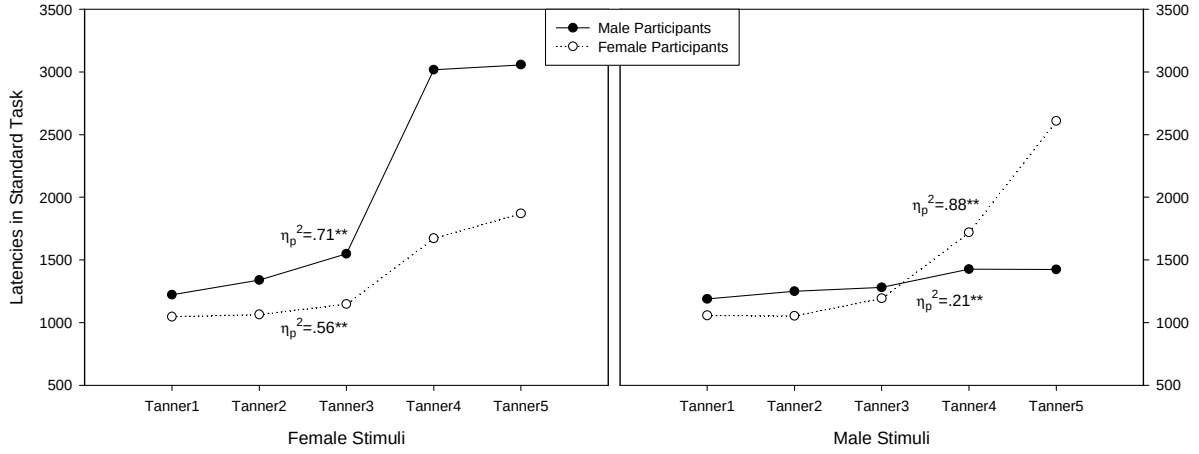
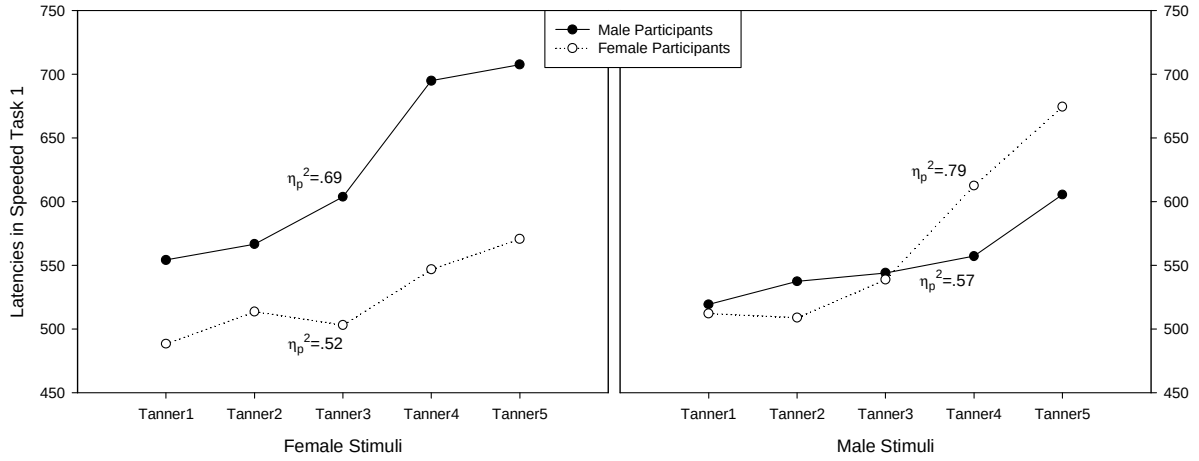


Figure 3

Panel A



Panel B



Panel C

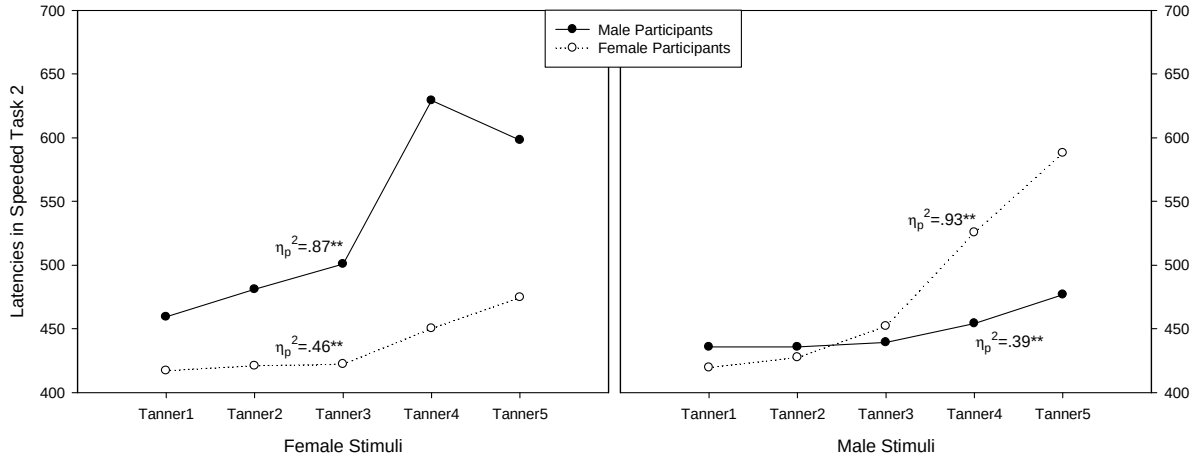
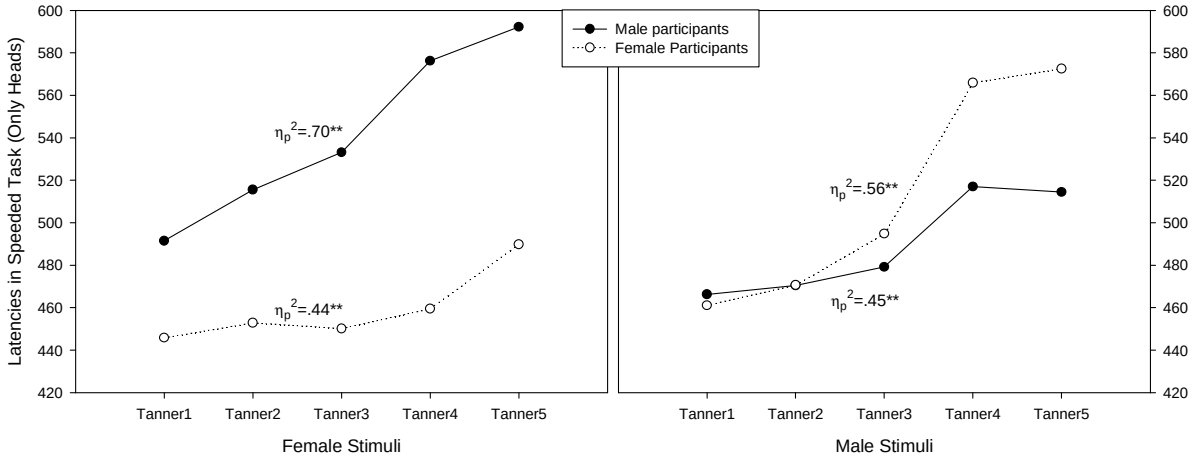


Figure 4


Latencies in Speeded Task (Only Heads)
600
580
560
540
520
500
480
460
440
420
Male participants
Female Participants
η_p^2=.70**
η_p^2=.44**
η_p^2=.56**
η_p^2=.45**
Tanner1
Tanner2
Tanner3
Tanner4
Tanner5
Female Stimuli
Male Stimuli