The Sexualized-Body-Inversion Hypothesis Revisited: Valid Indicator of Sexual Objectification or Methodological Artifact?

Alexander F. Schmidt

Lisa M. Kistemaker

University of Bonn

Accepted for Publication in COGNITION

Please cite as

Schmidt, A. F., & Kistemaker, L. M. (in press). The Sexualized-Body-Inversion Hypothesis Revisited: Valid Indicator of Sexual Objectification or Methodological Artifact? *Cognition.*

Alexander F. Schmidt, Department of Psychology, Social and Legal Psychology, University of Bonn, Bonn, Germany. Lisa M. Kistemaker, Department of Psychology, Social and Legal Psychology, University of Bonn, Bonn, Germany.

Correspondence concerning this article should be addressed to Alexander F. Schmidt, Department of Psychology, Social and Legal Psychology, University of Bonn, Kaiser-Karl-Ring 9, 53111 Bonn, Germany. E-mail: afschmidt@uni-bonn.de

Abstract

Recently, Bernard, Gervais, Allen, Campomizzi, and Klein (2012) reported that individuals were less able to recognize inverted vs. upright pictures of sexualized men as compared to women. Based on their formulation of the sexualized-body-inversion hypothesis (SBIH) it was concluded that sexualized women as compared to men are perceived in a more object-like manner supporting sexual objectification (SO) of females – independent from observer gender. We challenge this interpretation and hypothesize that the originally reported effect is the result of a methodological artifact due to gender-symmetry and stimuli setup-symmetry confounds in the original stimulus set. We tested this theoretically more parsimonious account in a methodologically stricter and extended conceptual replication of the putative SO-effect. Results from two studies showed that the original stimulus set indeed suffered from symmetry confounds and that these are necessary boundary-conditions in order for the hypothetical SO-effect to occur. It is concluded that the SBIH as postulated by Bernard et al. (2012) is based on a methodological artifact and cannot be related to SO but symmetry detection.

Keywords: Sexual objectification, person perception, object perception, body-inversion effect, artifact

The Sexualized-Body-Inversion Hypothesis Revisited:

Valid Indicator of Sexual Objectification or Methodological Artifact?

1. Introduction

Sexual objectification (SO) refers to the separation of the body, body parts, or body functions from an individuals' personality and to the reduction of these bodily characteristics to mere instruments to satisfy the needs and desires of other people (Bartky, 1990). Originally conceptualized with a strong focus on females as the most frequently sexually objectified gender in everyday life (Fredrickson & Roberts, 1997; Heflick & Goldenberg, 2014; Swim, Hyers, Cohen, & Ferguson, 2001; but see Rohlinger, 2002, for increasing SO of males) it has been shown that experiencing SO – mediated by sexual self-objectification (for an overview see Moradi & Huang, 2008) – is detrimental to psychological well-being (e.g., increased body shame, anxiety) and mental health (e.g., risk factor for eating disorders, depression, sexual dysfunctions). Moreover, experienced SO has a more negative impact on females than on males (e.g., Gervais, Vescio, & Allen, 2011; Moradi & Huang, 2008; Swim et al., 2001).

Recently, an interesting line of research started to explore how SO is linked to person vs. object recognition. Based on findings from cognitive psychology on global vs. local/configural vs. analytical processing the basic underlying hypothesis is that SO leads to a more object-like (as opposed to person-like) perception of other individuals. In line with this notion, Gervais, Vescio, Förster, Maass, and Suitner (2012) hypothesized a sexual body part recognition bias and showed that female as compared to male bodies were increasingly reduced to their sexual body parts in perceivers' minds. From the same theoretical framework Bernard, Gervais, Allen, Campomizzi, and Klein (2012) derived the *sexualized-body-inversion hypothesis* (SBIH) reporting that individuals were less able to correctly recognize inverted vs. upright pictures of sexualized men whereas this inversion effect did not show for similar depictions of sexualized women. Bernard et al.

(2012) concluded from their results that sexualized women had been perceived as objects whereas sexualized men had been processed as persons. They interpreted this as an indication that "cultural beliefs that women are sex objects are shared by both men and women at a basic cognitive level" (Bernard et al., 2012, p. 470). In the present study we sought to challenge these interpretations from Bernard et al. (2012) with a methodologically more rigorous conceptual replication that tested a parsimonious alternative explanation for the reported putative SO-effect[1].

1.1 Sexualized-Body-Inversion Hypothesis

Based on their interpretation of basic cognitive psychology research, Bernard et al. (2012) sought to utilize differential information processing patterns that are involved in object vs. person recognition as behavioral indicators of SO. Their theoretical reasoning rested on well-established findings that person perception (i.e., perception of faces and body-postures) is commonly based on configural relations among constitutive fragments of a person stimulus (i.e., *configural processing*; Maurer, LeGrand, & Mondloch, 2002). Hence, human person perception becomes more difficult when inverted vs. upright individuals have to be recognized due to the changes in characteristic stimulus configurations in the inverted stimuli (e.g., Yin, 1969). In contrast, object recognition depends only to a lesser degree on the processing of spatial relations between different stimulus fragments (i.e., *analytic processing*). Thus, configural vs. analytical processing is more vulnerable to inversion effects (body-inversion effect; Reed, Stone, Bozova, & Tanaka, 2003; Reed, Stone, Grubb, & McGoldrick, 2006; but see, for example, Hayward & Tarr, 1997 for critical boundary conditions).

[1] As the Bernard et al. (2012) study was originally published in *Psychological Science* we first have submitted this research to this journal. It has been rejected without having been sent out for reviews for two reasons: a) the manuscript was regarded as too long for a critical comment and b) the editors were missing broadly compelling advance usually sought out for publication in *Psychological Science*. Hence, the editors recommended publication in a leading speciality journal.

From these findings Bernard et al. (2012) derived the SBIH postulating that women who in general are subject to greater SO are more likely to be processed as objects (i.e., in an analytical manner) as opposed to men who are more likely to be processed as persons (i.e., in a configural manner). Combining these perceptual processing differences with the body-inversion effect, Bernard et al. (2012) concluded that the recognition of (more object-like) women should be less impaired by the body-inversion effect than the recognition of (more person-like) men. In order to empirically support their reasoning, Bernard and colleagues presented upright and inverted pictures of sexualized women and men (i.e., underwear shots) to their female and male participants. After each trial, participants had to discriminate the target stimulus from a distractor left-right mirror image. The authors interpreted the finding that the body-inversion effect (i.e., inverted stimuli are more difficult to recognize than upright stimuli) – independent of participant gender – only affected recognition rates of male but not female stimuli as support for the SBIH (Bernard et al., 2012).

1.2 Criticism of the Sexualized-Body-Inversion Hypothesis

The interpretation of the results from Bernard and colleagues (2012) has been challenged (Tarr, 2013). On a theoretical level, Tarr questioned the original authors' claim that object recognition is generally resistant against inversion effects as it has been shown that numerous other task- and/or perceptual factors influence the impact of inversion on object recognition (e.g., Tarr, Bülthoff, Zabinski, & Blanz, 1997). Applied to the original SBIH-task this means that the onus is on Bernard et al. (2012) to rule out that stimulus gender had not been confounded with other possible perceptual or task-related factors in order to maintain their interpretation as support for the SBIH – a relevant criticism as acknowledged by Bernard, Gervais, Allen, and Klein (2013) in their reply to Tarr (2013). In fact, over and above further theoretical criticism brought forward by Tarr (2013; e.g., attentional differences while encoding male and female stimuli that also would result in differential reaction time patterns[2]) a much more parsimonious alternative explanation for the reported differential inversion-effect pattern could be found in the nature of the task: As discriminating left-right mirror images is directly dependent on the symmetry of the stimuli (i.e., the more asymmetric the stimuli, the easier the task), Bernard et al.'s (2012) interpretation could only be valid if there were no symmetry (or other perception-based) differences between their male and female stimuli (Tarr, 2013). However, the two sample stimuli depicted in Bernard et al. (2012, Figure 1, p. 470; see also Figure 2 in this study) clearly differ in symmetry cues: The female individual is depicted in a rather s-shaped posture whereas the male stimulus exhibits a much more linear shape. If this held true for the whole stimulus set used in the study it simply might have been easier to detect female than male stimuli from the mirror images due to greater asymmetry of the female stimuli – a pattern that would have resulted in a main effect of target gender (unfortunately, only interaction effects were reported in the original paper) but seems reconcilable with the reported recognition rates (Bernard et al., 2012, Figure 1, p. 470). Moreover, this effect should be more pronounced when (due to the inversion of stimuli) analytical vs. configural processing becomes more important. This alternative explanation would as well predict the interaction pattern reported by Bernard et al. (2012).

Additionally, a similar – mutually not exclusive – methodological confound might further have contributed to the reported SBIH-effects. As Bernard et al. (2012) have presented different subsets of stimuli in upright and inverted orientations (i.e., participants saw differing male and female stimuli in upright and inverted conditions), they did not control for potential symmetry differences between the stimuli subsets used for upright vs. inverted presentation in their experimental design. If the inverted female stimuli had been more asymmetric than the upright female stimuli (i.e., a stimuli setup-symmetry

[2] Replying to Tarr (2013) Bernard et al. (2013) reported further results based on reaction times and could rule out an accuracy-speed trade-off as a potential alternative explanation of the SBIH.

confound) this would have artificially inflated the proposed SBIH-effect adding to the potential gender-symmetry confound as described above.

Finally, another criticism that has also been raised by Tarr (2013) concerns the lack of a less sexualized but otherwise similar stimulus contrast group that would have been necessary to interpret the SO assumption of the study. Simply presenting pictures of individuals in underwear does not rule out alternative explanations instead of the sexualization account. It might be the case that lesser eroticized stimuli could have caused the same effects, thus speaking against the sexualization aspect of the SBIH (unless one is willing to hypothesize that all depictions of females are inherently sexualized – this, however, would be a non-falsifiable immunization).

In summary, providing more parsimonious possible alternative explanations that are consistent with Tarr's (2013) criticisms, we conclude that without a conceptually extended replication of the results reported by Bernard et al. (2012), it cannot be decided whether the originally formulated SBIH is a valid hypothesis or rather an methodological artifact due to gender-symmetry confounds in the original stimulus set and study design.

2. Present Study

In order to test alternative explanations of the SBIH we sought to conceptually replicate the results from Bernard et al. (2012) under experimentally more controlled conditions. Therefore, in a first study we tested whether the stimulus set utilized by Bernard and colleagues suffered from confounded symmetry cues. We first hypothesized that female as compared to male stimuli were less symmetric and, thus, due to increased ease of detection could explain the finding that the body-inversion effect was less pronounced for female stimuli in the original study.

Additionally, we wanted to clarify whether a symmetry confound between upright and inverted stimuli subsets might additionally have contributed to Bernard et al.'s (2012) findings as well. Thus, in a second study, we sought to replicate Bernard et al. (2012)

utilizing their original stimulus setup and contrast their effects to the results of an extended and stricter experimental design by controlling for differences between upright and inverted stimuli subsets that have not been counterbalanced in the original study.

Moreover, we also incorporated a new stimulus set consisting of symmetry-matched stimuli and a less sexualized control category. The latter manipulation was incorporated in order to explore whether the sexualized nature of the stimuli impacts on SO-effects under fully controlled symmetry-matched conditions. If less eroticized stimuli produced smaller SO-effects as compared to the more sexualized stimuli it would be corroborated that the SBIH is indeed based on SO. However, it would strongly speak against the internal validity of the original study if symmetry differences between (a) male and female stimuli and/or (b) upright and inverted female stimuli as used by Bernard et al. (2012) could be demonstrated *and* if SO-effects would not replicate with either the methodologically more controlled whole original stimulus set (i.e., counterbalanced upright and inverted stimuli) and a newly constructed symmetry-matched stimulus set. In this case, the SBIH would instead have resulted from a methodological artifact due to symmetry confounds.

3. Study 1 – Symmetry of Stimuli

Our first aim was to test whether gender-symmetry and/or a stimulus subset-symmetry confounds could be detected in the original stimulus set used by Bernard et al (2012). Therefore, we explored whether male and female stimuli and upright vs. inverted stimuli subsets differed in the symmetry of their depicted body postures.

3.1 Method

Bernard and colleagues kindly shared their stimuli set with us (N = 48 pictures of individuals in underwear or bathing clothes, half of them depicting females). In order to quantify body-posture symmetry, five body-axes were drawn through parallel body parts (i.e., eyes, shoulders, elbows, hands, hips) and the angles between these lines and the horizontal were measured. These body-axis angles indicated stimulus symmetry: The greater the angles, the more asymmetric the body posture of the stimulus.

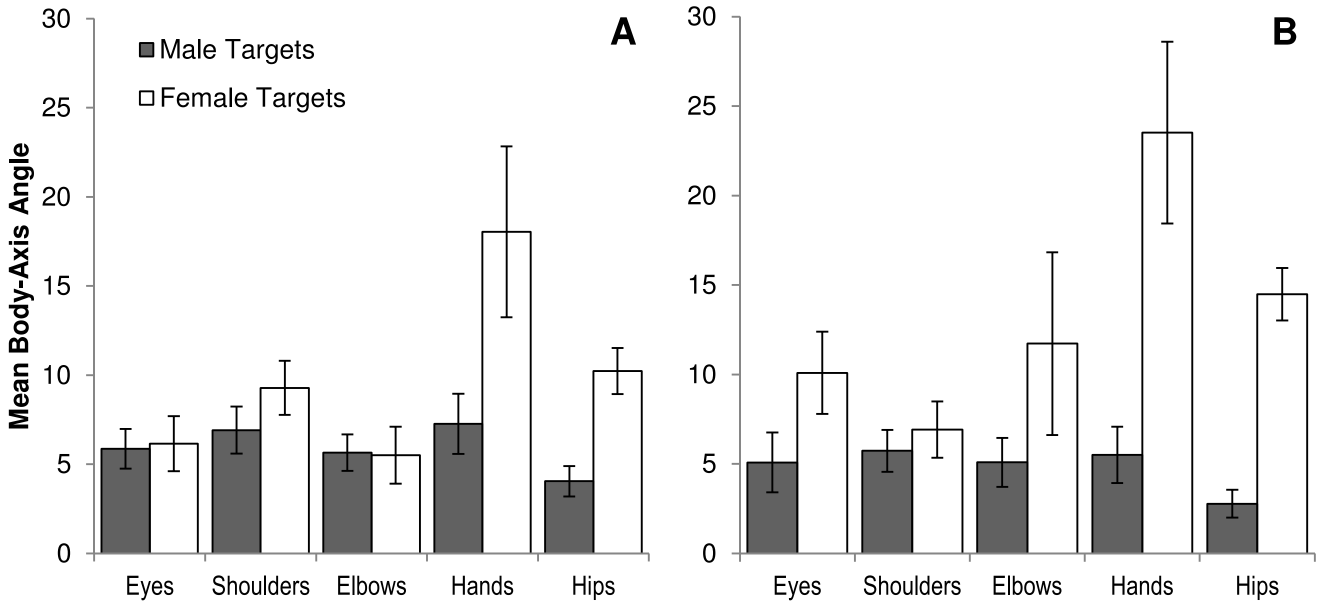

Figure 1. Body-axis angles of the stimuli presented in Bernard et al.'s (2012) original study design as a function of stimulus gender, body-axis, and stimulus orientation. Panel A upright stimulus presentation, Panel B inverted stimulus presentation. Error bars ± 1 *SE*.

3.2 Results

A 2 (Stimulus Gender) x 2 (Stimulus Orientation) x 5 (Body-Axis) mixed-model ANOVA with Stimulus Gender and Stimulus-Orientation as between stimulus factors, Body-Axis as within-stimulus factor, and deviations of the body-axes from the horizontal as dependent variable revealed large main effects of Stimulus Gender, $F(1, 44) = 18.36$, $p < .001$, $\eta^2 = .29$, and of Body-Axis, $F(4, 41) = 5.80$, $p < .01$, $\eta^2 = .36$. Stimulus Orientation did not exert a significant main effect, $F < 1$. Female stimuli exhibited generally increased angles with, specifically, hands and hips being the most asymmetric body-axes (Figure 1). These main effects were further qualified by a particularly strong

Body-Axis x Stimulus Gender two-way interaction, $F(4, 41) = 8.53$, $p < .001$, $\eta^2 = .45$, with especially female hand and hip-axes showing increased asymmetry. Neither the Stimulus Gender x Stimulus Orientation, $F(1, 44) = 2.54$, $p = .12$, $\eta^2 = .06$, the Body-Axis x Stimulus Orientation, $F(4, 41) = 1.51$, $p = .22$, $\eta^2 = .13$, nor the Stimulus Gender x Stimulus Orientation x Body Axis, $F(4, 41) = 1.45$, $p = .24$, $\eta^2 = .12$, interactions were significant, although especially the latter two effect sizes were substantial (Figure 1). Bonferroni-adjusted post-hoc dependent sample t-tests of inverted vs. upright stimuli across all body-axes were non-significant. However, due to the low statistical power resulting from only 12 pictures per stimulus subset we inspected the effect sizes on a descriptive level: In accordance with the substantial effect sizes of the interactions involving Stimulus Orientation, female stimuli as presented in the original study showed descriptively larger angles for inverted vs. upright orientations on the hip, $d = 0.89$, eyes, $d = 0.58$, elbows, $d = 0.47$, and hands, $d = 0.29$, body axes with the exception of the descriptively smaller shoulder angles, $d = -0.44$. For the originally presented male stimuli the pattern was less pronounced and ran in the opposite direction with descriptively smaller angles in the inverted vs. upright orientations (hips, $d = -0.45$, hands, $d = -0.31$, shoulders, $d = -0.27$, eyes, $d = -0.16$, elbows, $d = -0.13$).

3.3 Discussion

Body-axis angles as asymmetry indicators revealed the hypothesized gender-symmetry confound in the stimulus set utilized by Bernard et al. (2012): The substantial main effect of Stimulus Gender and the Body-Axis x Stimulus Gender interaction clearly corroborated that women’s postures were more asymmetric. Thus, it was easier to detect female as compared to male targets in Bernard et al.’s (2012) recognition task because discrimination of a target from a left-right mirror image profited from the increased asymmetry that was present in the female stimuli. Additionally, although not statistically significant, the quite substantial effect sizes for the differences between inverted vs.

upright stimuli (four out of five body-axes pointing towards increased asymmetry in the inverted female stimulus category and a less pronounced but opposite pattern for male stimuli) underscore that these also might have impacted on the recognition rates reported in the original study because the original experimental setup rendered it particularly easy to correctly recognize women in the inverted condition (as these represented the most asymmetric stimuli in the whole stimulus set). These stimuli features specifically call for counterbalancing of upright and inverted stimuli subsets in order to statistically rule out such a liability to the original study design in a future test of the SBIH. In consequence, the demonstrated gender-symmetry confound and the putative stimulus subset-symmetry confound might propose a much more parsimonious alternative explanation for the originally reported effects than the account of the SBIH proposed by Bernard et al. (2012). This was empirically tested in Study 2.

4. Study 2 – Conceptual Replication of the Sexualized-Body-Inversion Hypothesis

The interpretation of Bernard et al. (2012) rests on a number of theoretical assumptions that cannot be directly derived from the original data (i.e., differential underlying processing mechanisms of inverted human stimuli dependent on target gender). Hence, in order to support the SBIH it is most crucial to demonstrate that SO-effects are not simply driven by potential symmetry confounds as suggested in Study 1. Therefore, we (a) sought to replicate the original study results utilizing the same stimuli as Bernard et al. (2012) but this time (b) testing whether the original body-inversion effects still held after counterbalancing *all stimuli in upright and inverted positions*. Furthermore, we (c) tried to conceptually replicate the original study utilizing a newly constructed stimulus set of male and female stimuli pictures that has been matched in terms of stimulus symmetry including (d) an experimental manipulation of stimulus sexualization to test whether it is indeed the sexualization component that drives the putative SO-effects. Only a conceptual replication of the original effects under all three more controlled experimental designs could be regarded as strong empirical support for the SBIH as postulated by Bernard et al. (2012).

4.1 Method

Sixty adults (50% women, mean age 34.5 years, *SD* = 13.4, range from 19 to 69 years, age being independent of gender, $t(51.61) = 1.86$, $p = .07$) provided informed consent prior to participating in the study. Participants followed the protocol of the recognition task as described in Bernard et al. (2012). In a first stage they completed the recognition task with the original stimuli from Bernard et al. (2012). However, in contrast to Bernard et al. (2012) all 24 photos of men and women from the original stimulus set were presented in upright and inverted orientation (96 trials). This was followed by a short break and the instruction that the second stage would include nude pictures as well. A newly constructed stimulus set that was matched according to the body-axes described above[3] was used in the second stage. It consisted again of each 24 pictures of men and women in a sexualized category (nude) and a lesser sexualized category (body covered with opaque skin colour from upper limb to upper chest in order to cover primary and secondary sexual characteristics but revealing the shape of the individuals, see Figure 3 for sample stimuli)[4]. Every target picture was presented once in upright and inverted orientation (192 trials). Stimuli in both stages were presented in randomized order, each for 250ms followed by a blank screen for 1.000ms and the original target and the left-right mirror distractor image as the recognition task.

4.2 Results

[3] A corresponding mixed-model ANOVA (see Study 1) revealed no significant effects of Gender or the Gender x Body-Axis interaction, $Fs < 1$, indicating that the new stimuli did not differ in gender-related symmetry indicators.
[4] Stimuli were tested in an independent sample ($N = 102$ participants, mean age 32.0 [SD = 10.3] years; 34% females). It showed that nude stimuli were perceived substantially more sexualized than body-covered stimuli, $F(1, 100) = 164.22$, $p < .001$, $\eta^2 = .66$. Post-hoc tests for male as well as for female stimuli were significant as well ($ps < .001$). Sexualization was operationalized according to the definition given in the Introduction of this article.

First, attempting to replicate the original results from Bernard and colleagues (2012) we restricted our analysis to the stimulus setup used in the original study (Figure 2, Panel A). We conducted a 2 (Participant Gender) x 2 (Stimulus Gender) x 2 (Stimulus Orientation) mixed-model ANOVA with Participant Gender as between-subjects factor, Stimulus Gender and Stimulus Orientation as within-subjects factors, and correct recognition rates as dependent variable. We found a theoretically trivial main effect of Stimulus Orientation, $F(1, 58) = 17.32$, $p < .001$, $\eta^2 = .23$, that resulted in better recognition of upright stimuli. In line with our hypothesis of a gender-symmetry confound we also observed a main effect of Stimulus Gender, $F(1, 58) = 8.49$, $p = .005$, $\eta^2 = .13$, showing better recognition rates for female targets. Participant Gender exerted no main effect, $F < 1$. Replicating Bernard et al. (2012), the critical interaction effect of Stimulus Gender and Stimulus Orientation was significant, $F(1, 58) = 10.48$, $p = .002$, $\eta^2 = .15$, and followed the hypothesized pattern (Figure 2, Panel A). No further interaction effects emerged (*F*s < 1). Additional Bonferroni-adjusted dependent sample post-hoc-tests also replicated the results from Bernard et al. (2012): Participants recognized upright males significantly better than inverted males, $t(59) = 5.18$, $p < .001$, but not in the case of upright vs. inverted females, $t(59) = 1.22$, $p = .23$. Also, inverted females were significantly better recognized than inverted males, $t(59) = 3.91$, $p < .001$, whereas this was not found for upright females vs. males, $t < 1$. The latter contrast showed that the main effect of Stimulus Gender was exclusively driven by the recognition rates for the inverted female stimuli.

Subsequently, we wanted to test whether the SO-effect reported by Bernard and colleagues (2012) was dependent on the gender-symmetry and stimuli subset-symmetry confounds suggested in Study 1. Now utilizing the fully counterbalanced design 8i.e., every stimulus was presented in upright and inverted conditions), we conducted a 2 (Participant Gender) x 2 (Stimulus Gender) x 2 (Stimulus Orientation) x 2 (Stimulus

Setup: Original stimulus setup from Bernard et al. (2012) vs. counterbalanced setup) mixed-model ANOVA with Participant Gender as between-subjects factor, Stimulus Gender, Stimulus Orientation, Stimulus Setup as within-subjects factors, and correct recognition rates for the stimuli from Bernard et al. (2012) as dependent variable[5]. We added the Stimulus Setup factor in order to control for the fact that Bernard et al. (2012) presented differing halves of male and female stimuli in the upright or inverted conditions.

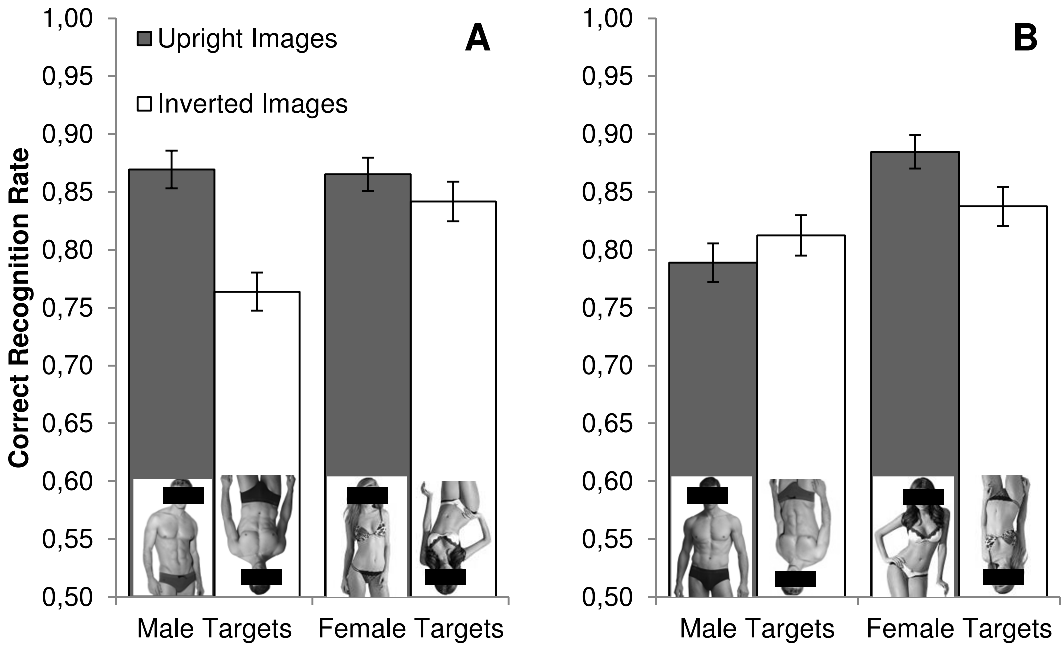

Figure 2. Rates of correctly recognized stimuli as a function of target gender, target orientation, and setup of stimuli from Bernard et al. (2012). All stimuli were presented without covering black bars. Panel A original setup from Bernard et al. (2012), Panel B reversed setup not tested in Bernard et al. (2012). Error bars ± 1 *SE*.

[5] A similar ANCOVA with Age as covariate revealed no significant main or interaction effects involving Age (*ps* > .18). Thus, for reasons of parsimony we report the results without the covariate included.

Again, we found the theoretically trivial main effect of Stimulus Orientation, $F(1, 58) = 14.48$, $p < .001$, $\eta^2 = .20$, that resulted in better recognition of upright stimuli (Figure 2, Panels A and B). In line with our hypothesis of a gender-symmetry confound we observed a large main effect of Stimulus Gender, $F(1, 58) = 30.07$, $p < .001$, $\eta^2 = .34$, showing better recognition rates for female targets. Participant Gender and Stimulus Setup yielded no main effects, $F < 1$. Notably, the Stimulus Setup x Stimulus Orientation interaction was significant, $F(1, 58) = 5.46$, $p = .02$, $\eta^2 = .09$, resulting in larger recognition rates for upright and lower detection rates for inverted stimuli in the original setup (Figure 2, Panel A) as compared to the counterbalanced setup (Figure 2, Panel B). Strikingly, including the counterbalanced stimuli set we could not replicate the critical Stimulus Gender x Stimulus Orientation interaction effect from Bernard et al. (2012), $F < 1$, showing that under more controlled conditions there was no SO-effect. However, most critically, this non-significant two-way interaction was qualified by interacting with Stimulus Setup, $F(1, 58) = 20.69$, $p < .001$, $\eta^2 = .26$, resulting in a reversed pattern for the counterbalanced half of the original stimuli not tested in the original study (Figure 2). This showed that the emergence of the putative SO-effect was dependent on the stimuli subsets used. Bonferroni-adjusted dependent sample post-hoc tests showed that no difference between female stimuli (i.e., SBIH-effect following the interpretation of Bernard et al., 2012) emerged in the case when more symmetric upright stimuli were contrasted against more asymmetric inverted stimuli (as done in the original study), $t(59) = 1.22$, $p = .23$ (Figure 2, Panel A) whereas in the counterbalanced condition a significant difference between female stimuli (i.e., no SBIH-effect according to Bernard et al., 2012) was revealed contrasting more asymmetric upright stimuli against more symmetric inverted stimuli, $t(59) = 2.82$, $p = .006$ (Figure 2, Panel B). For male stimuli this pattern was reversed with significantly different recognition rates (i.e., no SBIH-effect) for more asymmetric upright stimuli as compared to more symmetric inverted stimuli, $t(59) = 5.18$,

$p < .001$ (Figure 2, Panel A) and no difference (i.e., SBIH-effect) between more symmetric upright and more asymmetric inverted stimuli, $t(59) = -1.16$, $p = .25$ (Figure 2, Panel B). The Stimulus Gender x Stimulus Orientation interaction was also qualified by Participant Gender, $F(1, 58) = 5.74$, $p = .02$, $\eta^2 = .09$, revealing increased detection rates of upright vs. inverted stimuli for opposite gender stimuli as compared to same-sex stimuli. No further interactions emerged (*p*s > .19).

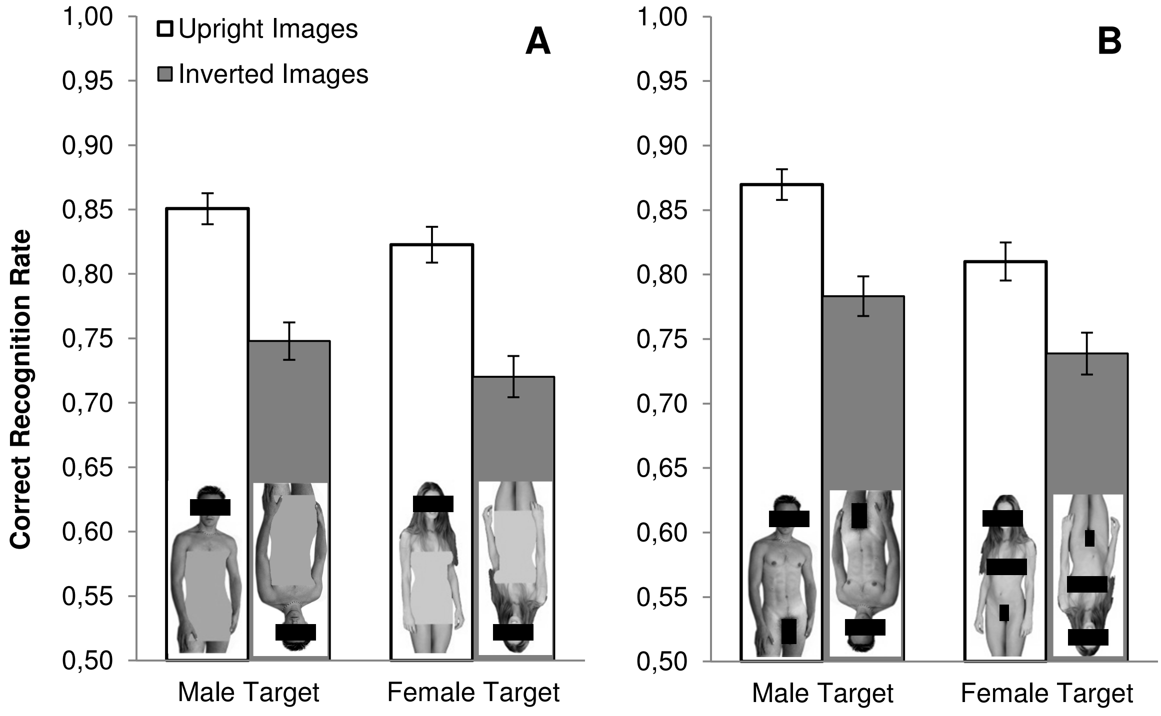

Figure 3. Rates of correctly recognized stimuli as a function of target gender and target orientation. All stimuli were presented without covering black bars. Panel A less sexualized stimuli, Panel B sexualized stimuli (sexualized stimuli were presented nude). Error bars ± 1 *SE*.

Finally, we wanted to test whether the putative SO-effects replicated utilizing a newly constructed symmetry-matched stimulus set and whether degree of sexualization was a causal factor for SO-effects. Hence, we conducted a 2 (Participant Gender) x 2

(Stimulus Gender) x 2 (Stimulus Orientation) x 2 (Degree of Sexualization) mixed-model ANOVA with Degree of Sexualization added as a further within-subjects factor and recognition rates for the symmetry-matched stimuli as dependent variable[6]. We replicated the trivial main effect of Stimulus Orientation, $F(1, 58) = 110.78$, $p < .001$, $\eta^2 = .66$, as indicated by better recognition rates for upright stimuli (Figure 3). Additionally, we observed main effects for Stimulus Gender, $F(1, 58) = 21.83$, $p < .001$, $\eta^2 = .27$, and Degree of Sexualization, $F(1, 58) = 4.27$, $p = .04$, $\eta^2 = .07$, showing increased recognition for men and for sexualized stimuli. Again, Participant Gender did not exert a main effect, $F < 1$. Critically, based on the symmetry-matched stimulus set the central interaction of Stimulus Gender and Stimulus Orientation was not significant, $F < 1$. All further interaction effects did not reach significance (*p*s > .08). Specifically, for all interactions involving Stimulus Gender and Stimulus Position effects that are critical to the SBIH F values < 1 emerged with the exception of the (still non-significant) full four-way interaction, $F(1, 58) = 2.24$, $p =.14$, $\eta^2 = .04$.

4.3 Discussion

Restricting our analyses to the study setup from Bernard et al. (2012) we replicated the pattern of results for the original non-counterbalanced subset of stimuli consisting of more asymmetric inverted females vs. more symmetric upright females (Figure 2, Panel A). However, statistically controlling for a possible stimulus setup-symmetry confound of the inverted as compared to the upright female stimuli (as suggested by the results from Study 1) the SO-effect vanished as the crucial Stimulus Gender x Stimulus Orientation interaction was not significant anymore (Figure 2, Panels A and B). More critically, for the other half of the stimuli (i.e., more asymmetric upright than inverted female stimuli; for male stimuli vice versa) that had not been presented in a counterbalanced condition in the original study the SO-effect reversed: Now for the male

[6] Again, an ANCOVA with Age as covariate showed no significant impact of Age (*p*s > .07).

stimuli a “SBIH-effect” emerged (as indicated by the significant Stimulus Gender x Stimulus Orientation x Stimulus Setup interaction). This corroborates that the putative SO-effect is dependent on the configuration of symmetry cues in the stimuli subsets. Only in the case when more asymmetric inverted cues are pitted against less symmetric upright cues – independent of stimulus gender – the “SO-effects” can be demonstrated. This corroborates that the original results from Bernard et al. (2012) are based on stimulus subsets effects that are highly likely to be symmetry-confounds with stimulus gender in general and with stimulus subsets, specifically.

Moreover, utilizing a fully counterbalanced newly constructed symmetry-matched stimulus set the crucial Stimulus Gender x Stimulus Orientation effect from Bernard et al. (2012) could not be replicated as target gender and body-inversion did not interact under these methodologically more controlled boundary conditions. This strongly corroborates that the original effect reported by Bernard et al. (2012) is indeed dependent on the hypothesized gender-symmetry and stimulus subset-symmetry confounds. Finally, in line with the lacking SO-effect under fully controlled symmetry conditions apart from a general main effect there was no specific impact of sexualization on the results.

5. General Discussion

Utilizing the same stimulus setup as in the original study we replicated the results from Bernard and colleagues (2012). However, in order to interpret these effects as actual SO of women based on the SBIH (i.e., sexualized women tend to be processed as objects whereas sexualized men tend to be processed as persons) two theoretical assumptions need to be shown to interact: First, it has to be established that the inversion of depicted individuals turns person perception into object perception. Second, it needs to be demonstrated that object recognition is not affected by inversion-effects. Only if both theoretical claims are valid the SBIH can be used to explain the psychological meaning of the differences in recognition rates of female and male stimuli.

Our results question the internal validity of the experiment that has been originally set up to establish the SBIH as a much more parsimonious explanation for the putative SO-effects from Bernard et al. (2012) is corroborated by the data presented here. Stimulus gender-symmetry confounds are equally well reconcilable with the results in question as discriminating left-right mirror images boils down to a simple symmetry detection task. This alternative explanation has the advantage that it does not involve complex theoretical suppositions about the degree to which recognition of objects and persons might differ.

Consistent with our notion we have shown that the stimuli utilized by Bernard et al. (2012) not only differed in the amount of symmetry cues with men exhibiting more symmetrical postures than females but that the inverted female stimuli were possibly even more asymmetric than the upright female stimuli used to establish the original SO-effect. Specifically, these confounds have rendered Bernard et al.'s hypothesis testing rather progressive. The rationale from Bernard and colleagues rests on showing that there was no difference in recognition rates for upright (i.e., configural processing) and inverted (i.e., analytical processing) female stimulus presentations. Therefore, detection rates for both tasks were artificially approximated as the more easy task (upright presentation) became more difficult (i.e., more symmetric stimuli) whereas the more difficult task (inverted presentation) became more easy (i.e., less symmetric stimuli). Utilizing the original stimulus set but controlling for the latter confound through counterbalancing of stimuli subsets we experimentally demonstrated in Study 2 that the SO-effect vanished when calculated across all stimuli: Neither stimulus gender nor participant gender interacted with the body-inversion effect and the original SO-effect – in accordance with descriptive symmetry differences for male and female Stimuli (Study 1) – even reversed when the original stimuli were used in opposite orientations. This means that according to the original account male but not female stimuli would, thus, have been subjected to SO-effects. This alone, in our view, sufficiently corroborates that the SBIH as presented by Bernard et al. (2012) is the result of a methodological artifact.

Although the effect sizes for the stimulus setup-symmetry confound were descriptively quite substantial and ran in opposing directions (Study 1) it might be argued that the described statistically non-significant body-axis differences between stimuli subsets are not convincing enough to corroborate symmetry confounds as the causal process underlying the postulated SBIH-effects (but note that the tests suffer from low statistical power due to quite small stimulus subsets). Therefore, in the second part of Study 2 we showed that with a newly constructed symmetry-matched and counterbalanced stimulus set the original SO-effect could also not be replicated. Additionally, we found that the degree of sexualization of stimuli is not a relevant boundary condition, as all higher order interactions involving a sexualization manipulation did not exert any significant effect on the recognition rates. This further questions the SBIH-account that emphasizes the impact of eroticization on the body-inversion effect. Hence, we conclude from our results that the recognition task from Bernard et al. (2012) does not meaningfully relate to SO but is in fact a measure of individuals' cognitive ability to detect symmetry differences. Therefore, the original authors' general conclusion that "cultural beliefs that women are sex objects are shared by both men and women at a basic cognitive level" (Bernard et al., 2012, p. 470) seems unwarranted as it is neither corroborated by their nor by our data. Certainly, this does not question the very presence of SO of females and males in general which constitutes a well-established social phenomenon (e.g., Heflick & Goldenberg, 2014; Moradi & Huang, 2008; Rohlinger, 2002).

In summary, our research underscores the necessity to carefully take into consideration basic cognitive processes in the construction of psychological paradigms that are meant to tap into higher social information processing (e.g., SO of women).

Because common interpretations of such paradigms rest on a number of auxiliary hypotheses about the underlying perceptual processes at work (e.g., Gervais et al., 2012) these kind of recognition tasks are specifically vulnerable to various lower-level perceptual confounds that threaten the internal validity of these experiments. Over and above the fact that Tarr (2013) criticized the highly generalized underlying theoretical framework for the SBIH according to Bernard and colleagues (2012) as an oversimplification (e.g., Hayward & Tarr, 1997; Tarr et al., 1997; Tarr & Pinker, 1989), a much more parsimonious explanation for the putative SO-effects from Bernard et al. (2012) is corroborated by the data presented here. Therefore, careful experimental control of such potential confounds is of utmost importance if valid inferences from such paradigms shall be drawn.

References

Bartky, S. L. (1990). *Femininity and domination: Studies in the phenomenology of oppression.* New York, NY: Routledge.

Bernard, P., Gervais, S. J., Allen, J., & Klein, O. (2013). Perceptual determinants are critical, but they don't explain everything: A response to Tarr (2013). *Psychological Science, 24,* 1071-1073. doi: 10.1177/0956797612474672

Bernard, P., Gervais, S. J., Allen, J., Campomizzi, S., & Klein, O. (2012). Integrating sexual objectification with object versus person recognition: The sexualized-body-inversion hypothesis. *Psychological Science, 23,* 469–471. doi: 10.1177/0956797611434748

Fredrickson, B. L., & Roberts, T.-A. (1997). Objectification theory: Toward understanding women's lived experiences and mental health risks. *Psychology of Women Quarterly*, *21*, 173–206. doi:10.1111/j.1471-6402.1997.tb00108.x

Gervais, S. J., Vescio, T. K., & Allen, J. (2011). When what you see is what you get: The consequences of the objectifying gaze for women and men. *Psychology of Women Quarterly*, *35*, 5–17. doi:10.1177/0361684310386121

Gervais, S. J., Vescio, T. K., Förster, J., Maass, A., & Suitner, C. (2012). Seeing women as objects: The sexual body part recognition bias. *European Journal of Social Psychology, 42,* 743-753. doi: 10.1002/ejsp.1890

Hayward, W. G., & Tarr, M. J. (1997). Testing conditions for viewpoint invariance in object recognition. *Journal of Experimental Psychology: Human Perception and Performance*, *23*, 1511–1521. doi: 10.1037/0096-1523.23.5.1511

Heflick, N. A., & Goldenberg, J. A. (2014). Seeing eye to body: The literal objectification of women. *Current Directions in Psychological Science, 23,* 225-229. doi: 10.1177/0963721414531599

Maurer, D., Le Grand, R., & Mondloch, C. J. (2002). The many faces of configural processing. *Trends in Cognitive Sciences, 6,* 255–260. doi:10.1016/S1364-6613(02)01903-4

Moradi, B., & Huang, Y.-P. (2008). Objectification theory and psychology of women: A decade of advances and future directions. *Psychology of Women Quarterly, 32,* 377–398. doi:10.1111/j.1471-6402.2008.00452.x

Reed, C. L., Stone, V. E., Bozova, S., & Tanaka, J. (2003). The body-inversion effect. *Psychological Science, 14,* 302–308. doi:10.1037/0096-1523.32.1.73

Reed, C. L., Stone, V. E., Grubb, J. D., & McGoldrick, J. E. (2006). Turning configural processing upside down: Part and whole body postures. *Journal of Experimental Psychology: Human Perception and Performance, 32,* 73–87. doi:10.1037/0096-1523.32.1.73

Rohlinger, D. A. (2002). Eroticizing men: Cultural influences on advertising and male objectification. *Sex Roles, 46,* 61-74. doi: 10.1023/A:1016575909173

Swim, J. K., Hyers, L. L., Cohen, L. L., & Ferguson, M. J. (2001). Everyday sexism: Evidence for its incidence, nature, and psychological impact from three daily diary studies. *Journal of Social Issues*, *57*, 31–53. doi: 10.1111/0022-4537.00200

Tarr, M. J. (2013). Perception isn’t so simple. Commentary on Bernard, Gervais, Allen, Campomizzi, and Klein (2012). *Psychological Science*, *24*, 1069–1070. doi: 10.1177/0956797612474669

Tarr, M. J., Bülthoff, H. H., Zabinski, M., & Blanz, V. (1997). To what extent do unique parts influence recognition across changes in viewpoint? *Psychological Science*, *8*, 282–289. doi: 10.1111/j.1467-9280.1997.tb00439.x

Tarr, M. J., & Pinker, S. (1989). Mental rotation and orientationdependence in shape recognition. *Cognitive Psychology, 21,* 233–282. doi: 10.1016/0010-0285(89)90009-1

Yin, R. K. (1969). Looking at upside-down faces. *Journal of Experimental Psychology, 81,* 141–145. doi:10.1037/h002747