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Perception Isn't So Simple: Commentary on Bernard, Gervais, Allen, Campomizzi, and Klein (2012)

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Bernard, Gervais, Allen, Campomizzi, and Klein (2012) report an inversion effect only when participants viewed sexualized male body images and not when they viewed sexualized female body images. On the basis of a belief that face and person recognition is subject to an inversion effect (Rossion, 2008; Yin, 1969) but that object recognition is not, the authors concluded that "at a basic cognitive level, sexualized men were perceived as persons, whereas sexualized women were perceived as objects" (p. 470). The inference is that different visual-recognition processes are applied to images of males and images of females. This conclusion is unwarranted on empirical, methodological, and logical grounds.

Empirically, the claim that object recognition is not affected by inversion is incorrect. There is an extensive literature demonstrating effects of planar rotation—and inversion—on both novel and familiar nonface and nonbody stimuli (Jolicoeur & Milliken, 1989; Lawson & Humphreys, 1996; Tarr & Pinker, 1989). That inversion effects can and do occur for everyday objects is not in debate; what is more complex are the conditions under which inversion effects occur or not (Tarr & Pinker, 1990). A wide range of factors have been implicated as exerting some influence on orientation effects (Biederman & Bar, 1999; Hayward & Tarr, 1997, 2000; Tarr, Bülthoff, Zabinski, & Blanz, 1997), and it is incumbent on Bernard et al. to establish whether any of these perceptual or task-related factors—that is, nonsocial components—might underlie the differential effects obtained for male and female images.

Without knowing whether the male and female stimuli differed along perceptual dimensions, one cannot ascertain whether the sex of the stimulus images was the underlying cause of the obtained effects. For example, the males in the stimulus images illustrated in the article may have shared similar hairstyles, and the females may have had more varied hairstyles; similarly, the male body poses may have been more symmetrical relative to the female poses. More generally, the complexity of the silhouettes, the number of perceptual features, the distinctiveness of specific features, the number of viewpoint-invariant properties, and image symmetry all may have influenced visual-recognition performance for inverted stimulus images.

Methodologically, as a dependent measure, Bernard et al. (2012) reported only the percentage of responses correct for each condition. Without reaction times, it is impossible to determine whether participants were simply spending more time looking at inverted female images—possibly because of social factors—and thereby achieving higher levels of performance for inverted female images relative to inverted male images. Looking for such a speed-accuracy trade-off is critical because its existence would implicate a difference in response biases (for whatever reasons), not a difference in perceptual processing per se (Gauthier, Behrmann, & Tarr, 1999).

A second methodological issue concerns a failure to include nonsexualized, but otherwise equated, stimuli as controls (an issue the authors acknowledge). This control is essential for assessing whether the effects are attributable to the sexual nature of the images. If nonsexualized images produced a pattern similar to those observed for sexualized images, this finding would severely undermine the validity of the sexualized-body-inversion hypothesis. This control's absence means there is no adequate way of interpreting the present results relative to plausible alternatives.

Logically, there is a question as to why inversion effects were not obtained for inverted female images, given that the distractor images were left-right mirror images of the targets. On the basis of the extensive mental-rotation literature, in which discriminating

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between mirror images of otherwise identical stimuli consistently produces robust costs for stimulus rotation (Shepard & Cooper, 1982), one would expect reliable inversion effects regardless of the stimuli. The preferred explanation of Bernard et al. (2012)—that the female images have been "objectified"—sidesteps the fact that visual content does not significantly affect task performance when observers are asked to make a mirror-image discrimination (Folk & Luce, 1987). Indeed, the "analytic processing" that Bernard et al. (2012) associate with object recognition would be *incapable* of supporting mirror-image discriminations that necessarily rely on the spatial relations between parts. Thus, the authors should consider what perceptual processes might have enabled good task performance.

Another logical issue, and one that also suggests an explanation for the authors' failure to find an inversion effect for female images, revolves around the role of attention. A wide variety of societal factors may lead participants to attend more to female images than to male images. Assuming that performance for upright images was near ceiling for the particular experimental conditions used in the study, greater attention to female images would drive performance for inverted female images closer to ceiling—the exact pattern of results that was reported. Similar to the concerns already noted, the critical issue is that this account implicates a difference in encoding biases, but not a difference in perceptual processing.

In sum, two overarching issues cloud the interpretation of Bernard et al.'s (2012) results. First, nonsocial, perceptual factors may explain the failure to find inversion effects for female images. Second, to the extent that social factors play a role, their influence may be exerted at a nonperceptual level—for example, by biasing looking time or attention. Without better controlled stimuli, further data analyses, and more sophisticated experimental designs, it is premature—particularly given the claimed real-world implications of this work—to suggest that the observed differences between male and female images with respect to inversion are attributable to "basic" visual or cognitive processes recruited in response to the "objectification" of females.

Of note, *Perspectives on Psychological Science* has recently published two articles voicing concerns about the "short report" format (Bertamini & Munafo, 2012; Ledgerwood & Sherman, 2012). In that Bernard et al.'s (2012) paper was published as a short report—which is briefer than the already-brief format popularized by journals such as *Psychological Science*—one wonders if some of the concerns raised here could have been avoided in a longer article format.

Declaration of Conflicting Interests

The author declared that he had no conflicts of interest with respect to his authorship or the publication of this article.

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What follows is Bernard, Gervais, Allen, Campomizzi, and Klein's reply.

With respect to response times, they state: "we report here reaction-time data for correct responses that were collected in our original experiment but not included in the original report (Bernard et al., 2012)."

The reasons why these data were not included in the original report are not clear, but it is worth noting that if one examines Fig. 1, it is clear that the RTs reveal an inversion effect for *both* the male and the female bodies. Moreover, the only significant effect they obtain for this data is a main effect for upright vs. inverted (the interaction is reported as "marginally significant" at $p = .096$, but with a relatively small effect size of .036). The critical point is that *had this data been included in the original paper* none of the authors' conclusions would have been valid in that they rest on a failure to obtain an inversion effect for female bodies – yet the RT data clearly show an inversion effect for female bodies.

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Perceptual Determinants Are Critical, but They Don't Explain Everything: A Response to Tarr (2013)

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Commenting on our research (Bernard, Gervais, Allen, Campomizzi, & Klein, 2012), Tarr (2013) stated that inferring that different visual-recognition processes (analytic vs. configural) are applied to images of sexualized males and females is "unwarranted on empirical, methodological, and logical grounds" (p. xx). Here, we address Tarr's comments with additional analyses from Bernard et al. (2012).

Regarding methodology, Tarr (2013) raised the possibility that our results could be explained by a speed-accuracy trade-off:

> Without reaction times, it is impossible to determine whether participants were simply spending more time looking at inverted female images—possibly because of social factors—and thereby achieving higher levels of performance for inverted female images relative to inverted male images. (p. xx)

Even though reactions times were recorded in our original experiment, only recognition scores were reported in Bernard et al. (2012). The shortness of our article did not compromise the integrity of the data presented in it. We opted to focus only on recognition scores because they are more relevant to examining the inversion effect than reaction times are. Indeed, some researchers have found that better recognition scores for upright bodies relative to inverted ones are associated with longer reaction times for inverted bodies relative to upright ones (e.g., Reed, Stone, Bozova, & Tanaka, 2003), whereas others have found an inversion effect in recognition scores in the absence of reaction-time differences (e.g., Yovel, Pelc, & Lubetsky, 2010).

However, to evaluate the possibility that a speed-accuracy trade-off could explain our results, we report here reaction-time data for correct responses that were collected in our original experiment but not included in the original report (Bernard et al., 2012). Following Tarr (2013), if a speed-accuracy trade-off underlies the better body-recognition performance for inverted females compared with inverted males, then reaction-time analyses should reveal longer latencies for recognizing inverted females compared with inverted males. Reaction-time analyses revealed an effect of position; inverted bodies elicited slower responses than upright bodies did, $F(1, 75) = 18.36$, $p < .001$, $\eta_p^2 = .197$. A marginally significant Position × Target Gender interaction also emerged, $F(1, 75) = 2.83$, $p = .096$, $\eta_p^2 = .036$, with inversion increasing response times more for male targets than for female targets.[1] As Figure 1 shows, response times for recognition of inverted females were not longer than response times for recognition of inverted males, a pattern of results that is inconsistent with a speed-accuracy trade-off for inverted-female-body recognition. Moreover, there was no effect of participant or target gender (all ps > .77), and the remaining interaction terms were not significant (all ps > .15). Additionally, inspection of simple correlations did not indicate a significant linear relation between recognition scores for inverted males, upright males, and upright females and their respective response times (all ps > .34). Finally, we found a negative correlation between response times and recognition scores for inverted female targets, $r(78) = -.24$, $p = .03$, which suggests that longer reaction times were associated with poorer recognition scores.

Because inversion prompts piecemeal processing (Maurer, Le Grand, & Mondloch, 2002), and because objectification can be conceptualized as a specific manifestation of piecemeal processing of bodies (i.e., a

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Fig. 1. Results from a supplemental analysis of data from Bernard, Gervais, Allen, Campomizzi, and Klein (2012): reaction times for correct responses as a function of target gender and picture orientation (upright vs. inverted). Error bars indicate ±1 *SEM*.

reduction of women to their body parts; Gervais, Vescio, Maass, Förster, & Suitner, 2012), the recognition and reaction-time data are consistent with our original hypothesis. Nonetheless, this does not imply equivalence between piecemeal processing and objectification (a term that dovetails distinct constructs; Nussbaum, 1995). It is important to note that more research is needed to better understand the relation between these processes and to explore potential confounds.

First, even if reaction-time data are inconsistent with a speed-accuracy trade-off, recognition scores may still be influenced by attentional biases (e.g., increased focus on female body parts relative to male body parts). Eye-tracking studies may be useful for identifying such intervening processes. Second, we agree with Tarr (2013) that we cannot exclude the possibility that perceptual nonsocial features that vary by target gender may have influenced recognition scores. One possibility for future research would be to rely on artificial bodies (e.g., Yovel et al., 2010). Indeed, using artificial bodies as stimuli would provide the opportunity to examine the impact of inversion on female- and male-body recognition while controlling for perceptual features and task factors that might contribute to how participants visually recognize sexualized bodies. In addition to body-recognition scores, indicators of analytic versus configural processing that rely less on physical body characteristics, such as event-related potentials (e.g., Stekelenburg & de Gelder, 2004) or fMRI (e.g., Brandman & Yovel, 2010), may be provided by neuroscience.

On logical grounds, Tarr (2013) stated that we should "consider what perceptual processes might have enabled good task performance" for female targets (p. xx) because the distractor images in our experiment were left-right mirror images of the targets. A plausible explanation—one that does not necessarily imply considering spatial relations between body parts—is that participants focused on sexual body parts when recognizing female targets, thereby minimizing the cognitive costs of mental rotation. Consistent with this notion, a *body-parts bias* (i.e., improved recognition of body parts relative to whole bodies) occurs when recognizing female (vs. male) targets (Gervais et al., 2012) and is exacerbated under local processing.

Finally, according to Tarr (2013), our hypothesis would be weakened if research revealed that non-sexualized images of women are prone to the same perceptual bias as sexualized images of women (i.e., an absence of an inversion effect). We believe that this comment stems from a misreading of our report. The purpose of our original article was to examine whether the recognition of sexualized targets depended on target gender, not to determine whether these differences are moderated by targets' sexualization. However, future research could examine our hypothesis in a more nuanced way by examining images of sexualized versus control (e.g., fully clothed) men and women.

In sum, Tarr (2013) identified relevant issues in our original article. Future research should disentangle how social factors (as opposed to perceptual characteristics of stimuli) contribute to the recognition of sexualized female and male bodies by relying on better-controlled stimuli. However, our original experiment and the additional analyses presented here are both consistent with our hypothesis that people rely on different forms of processing when recognizing sexualized women and men.

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Note

1. The statistical significance of this interaction increased considerably when we excluded one extreme observation (response time > 3 *SD* above the mean), $F(1, 74) = 7.22$, $p < .01$, $\eta_p^2 = .09$. However, the inclusion of this value did not affect the direction or statistical significance of any other effects reported in this article.

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