Psychology of Aesthetics, Creativity, and the Arts

Why Do Non-Artists Draw the Eyes Too Far Up the Head? How Vertical Eye-Drawing Errors Relate to Schematic Knowledge, Pseudoneglect, and Context-Based Perceptual Biases

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Why Do Non-Artists Draw the Eyes Too Far Up the Head? How Vertical Eye-Drawing Errors Relate to Schematic Knowledge, Pseudoneglect, and Context-Based Perceptual Biases

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Schematic Knowledge and Drawing

Research on the drawings produced by children and unskilled adults has long indicated that observational drawings are not exclusively guided by bottom-up, perceptual processing of the

(1983) generalizes to performance in a free-hand drawing task where adult participants are asked to draw the entire model without selectively attending to the task of only drawing the eyes.

Second, if we find that the perceptual processing of the hair line affects eye-drawing performance, it remains open to question as to whether this perceptual-based drawing bias to draw the eyes too far up the head is mediated by the knowledge or lack thereof that the eyes are positioned half-way down the head. Previous research has demonstrated that explicit knowledge about the veridical properties of a stimulus can have the effect of reducing the magnitude of individuals' experience of perceptual illusions (e.g., Khorasani, Fadardi, Fadardi, Cox, & Sharif, 2007). Thus, another goal of the present study was to investigate whether the potential effect that the presence versus absence of hair has on vertical eye-drawing accuracy differs between individuals with and without accurate schematic knowledge pertaining to the spatial positioning of the eyes.

Attention and Drawing: Pseudoneglect

Another possible psychological factor related to the bias to draw the eyes too far up the head may be attentional in nature. Specifindicated that they had taken one drawing class before high school. When asked to rate their drawing ability on a scale of 1 ( ) to 10 (*e ce ll e* ; *M* rating = 4.07, *SD* = 1.80). Further, when asked to indicate time spent drawing (*M* response = 0.44, *SD* = 0.85 hours per week).

Materials

Participating in the experiment entailed completing two drawing tasks, a vertical line bisection task, and one questionnaire.

Free-hand drawing task. Participants were asked to create one drawing each of two computer-generated images of an adult male face shown in fronto-parallel view (see Figure 1). The face models were created using the FaceGen Modeler software program (Version 3.1). Both faces were generated by setting the shape and texture of the face to the (a) "male" gender setting, (b) "30-year-old" age setting, (c) "average" caricature setting, (d) "symmetric" asymmetry setting, and (e) "all races" race-morph setting. A face texture was applied to make the face appear more natural (detail texture setting = "middle male 04" set at a modulation value of 1.0 and a gamma correction value of 1.8).

The two face models were identical in appearance, with the exception that one image depicted a bald male (bald stimulus) and the other image depicted a male with short black hair (hair stimulus). For the latter, the hair was generated by using the "short black hair" setting under the texture overlay option. From the top of the head, the lowest portion of the scalp line was positioned 21.2% down the length of the head. The face models were presented against a white background and displayed to participants one theyedtimeyedtheyed"aleyedcompualeyeddisplayts in the previous task. The experimenter displayed one of the two model faces on the monitor and provided the paper with the preprinted head contour. As in Clare (1983), the experimenter instructed participants to draw two ovals within the contour of the head with three goals: (1) to accurately reproduce the vertical position of the eyes along the length of the head, (2) to accurately reproduce the width of each eye, and (3) to accurately reproduce the horizontal distance between the two eyes. Participants were informed that they were allowed to erase and modify their drawing lowest portion of the nose. *D* was a measurement of the vertical distance between the top of the head and the space between the upper and lower lips of the mouth. *E*, only measured for the model with hair, was a measurement of the vertical distance between the top of the head and the lowest point of the hairline.

From these measurements, four spatial relation ratios were computed. *B/A* was a measure of the vertical position of the eyes relative to the height of the head (model value = 0.47). *C/A* was a measure of the vertical position of the nose relative to the height of the head (model value = 0.69). *D/A* was a measure of the vertical position of the mouth relative to the height of the head (model value = 0.80). *E/A* was a measure of the vertical position of the lowest point of the scalp-line relative to the height of the head (model value = 0.21).

Free-hand drawing task. The same four measurements (A through D) and three spatial relation ratios (B/A, C/A, and D/A) were measured and computed for each of the free-hand drawings. For drawings of the model with hair, measurement of *E* was made and the spatial relation ratio *E/A* was calculated. On the basis of these spatial relation ratios, eye, nose, mouth, and scalp-line *d a* -
errors were calculated as

Drawing Error = Drawing Ratio Value − Model Ratio Value

Calculated in this way, positive error values indicate that a feature was drawn too far down the head, and negative error values indicate that a feature was drawn too far up the head, relative to their position in the model.

Eye-drawing task. The B measurement was made for each eye-drawing, which allowed for calculation of the B/A ratio. Errors in drawing the vertical position of the eyes were calculated in the same way as in the free-hand drawings.

Vertical line bisection task.

The results of these analyses, including effect sizes, are shown in Table 2. With respect to the vertical positioning of the eyes, participants in both the knowledge and nonknowledge groups showed a bias to draw the eyes too far up the head when drawing the model both with and without hair. These biases were significant at the .007 α level, except for the knowledge group's drawing of the model with hair (however, $< .05$).

With respect to the vertical positioning of the nose, participants in the knowledge and nonknowledge groups showed a bias to draw the nose too high up the head when drawing the bald model. However, when drawing the hair model, participants in both groups did not exhibit such a bias at the .007 α level (although the nonknowledge group exhibited an upward bias at the .05 α level; $> .05$ in the drawings of the knowledge group).

With respect to the vertical positioning of the mouth and the lowest point of the hairline, neither the knowledge nor nonknowl-

Effects of Knowledge and Presence Versus Absence of Hair on Spatial Drawing Errors

Free-hand drawing task. To determine whether schematic knowledge of the vertical position of the eyes on a head and the presence versus absence of hair affects errors in the drawing of the vertical position of the eyes, a 2 (knowledge: knowledge vs. nonknowledge Conditions) × 2 (model stimulus: with hair vs. bald) analysis of variance (ANOVA) was conducted. We found a main effect of model stimulus, $F(1, 59) = 23.02$, $< .001$, partial $\eta^2 = .28$, indicating that, overall, participants' errors in drawing the vertical position of the eyes was larger when drawing the bald model than when drawing the model with hair. Further, there was a main effect of knowledge, $F(1, 59) = 7.31$, $< .01$, partial $\eta^2 = .11$, indicating that, overall, participants in the knowledge condition erred less in drawing the vertical position of the eyes than participants in the nonknowledge condition. However, there was a significant Knowledge × Model Stimulus interaction, $F(1, 59) = 4.75$, $<$

drawn even farther up the head in the bald model than in the model with hair.

Participants in the knowledge condition did not significantly differ with respect to the drawn vertical position of the eyes between when drawing the bald and nonbald models. This interaction between knowledge and the presence versus absence of hair cannot be accounted for by potential differences in how the hairline was drawn between the two groups, as the drawn vertical position of the hairline did not differ between participants in the knowledge and nonknowledge conditions. This suggests that the reason individuals in the knowledge condition drew the eyes too far up the head was not related to inattention and perceptual attenuation of the forehead region.

Altitudinal pseudoneglect. The finding that vertical line bisection errors were positively correlated with vertical eye-drawing errors for participants in the knowledge condition demonstrates that there is a relationship between the mechanisms responsible for altitudinal pseudoneglect and the bias to draw the eyes too far up the head when one has acquired the schematic knowledge of the spatial positioning of the eyes. Upward biases in vertical line bisection tasks have been theorized to be caused by asymmetries in how attention is deployed between the upper and lower visual fields, with greater attention deployed to the upper than lower visual field (e.g., McCourt & Olafson, 1997). Although one cannot confidently make causal interpretations of correlational results, one may speculate that when participants acquire and attempt to use the knowledge for drawing purposes that the eyes are positioned approximately half-way down the head, their errors in drawing the eyes too far up the head may be caused by pseudoneglect of the lower visual field that contains the lower portion of the face. This would result in the consequence of drawing the eyes too far up the head just as pseudoneglect of the lower visual field causes upward biases in vertical line bisections.

The magnitude of bisection and vertical eye-drawing errors were not significantly correlated for participants assigned to the nonknowledge condition. Therefore, it appears that altitudinal pseudoneglect is only related to eye-drawing errors when individuals have the knowledge that the eyes are positioned approximately half-way down the face. Before acquiring the knowledge that the eyes are positioned approximately half-way down the head, drawing the eyes too far up the head is an error that does not appear to be related to attentional processes responsible for altitudinal pseudoneglect.

Thus, even though both participants in the knowledge and nonknowledge conditions both experienced the systematic bias to draw the eyes too far up the head, the underlying basis of the bias appears to differ between individuals who do versus do not possess schematic knowledge that the eyes are positioned approximately half way down the face. Beyond such knowledge reducing the magnitude of vertical eye-drawing errors, it has the additional effect of altering the attentional processes that guide the perceptual encoding of faces for the purposes of drawing the vertical position of the eyes.

Differences Between the Free-Hand Drawing and Eye-Drawing Tasks

Clare (1983) was the first, and to our knowledge the only, other study that assessed the effects that the presence versus absence of hair have on errors in drawing the vertical position of the eyes. Using what has been termed the eye-drawing task here, Clare (1983) observed that errors were larger when children drew the model with hair compared to when they drew the model without hair. In the eye-drawing task, we replicated this effect, with the novel findings that this effect is also observed (a) in adults and (b) when using a repeated-measures design (Clare used a between-the positioning of some internal features to be directly affected by the positioning of other drawn internal features. For instance, in the free-hand drawing task, the demand of having to draw the scalp-line in the nonbald model may have been the cause as to why participants positioned the eyes, nose and (to a lesser extent) the mouth farther down the head than when this demand was absent in the bald model.

Because the eye-drawing task did not require participants to draw the entire face, a motor program representing the sequence of marks to be made to produce a drawing of a full face was not likely to have been activated and used by participants in this drawing task. Because graphic motor schemas have been theorized to affect how individuals visually process and attend to a model that is being drawn (Kozbelt & Seely, 2007), the absence of such a full-face motor program may have altered how participants attended to and processed the vertical eye position of the model face in the eye-drawing task relative to the free-hand drawing task. For instance, the spatial position of the eyes may have been processed relative to its perceived vertical distance from the top of the head. This may explain why, overall, the eyes were positioned higher up the head in the eye-drawing task than in the free-hand drawing task (with respect to the drawings of both models produced by both groups of participants). If this were the case, Clare's (1983) hypothesis that individuals mistakenly perceive the scalp-line as the top of the head could have caused the eyes to be positioned farther up the head when the model had hair compared to when the model was bald.

Unfortunately, we did not observe and record the participants' sequential approach to creating the drawings that were analyzed in this study. Thus, we are not in a position to evaluate the speculative hypotheses described in the previous three paragraphs. Nevertheless, the discrepancy between the effects found between the eye-drawing and (and)-406.5effects12(of)-512(suci-241suci-24nand)-406.8(hair)-2o(tive)ese eyeseyeseyeseyeseyes1(model)-456.1(athat)-3908cipant1
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Hogarth, B. (2002). *D a e a ead*. New York, NY: Watson-Guptill Publications.

Khorasani, A. A., Fadardi, J. S., Fadardi, M. S., Cox, W. M., & Sharif, J. T. (2007). Effect of practice versus information on the visual illusion. *Ne c e ce B 0e , 23,* 30–34. http://dx.doi.org/10.1007/s12264-007-0004-3

Kozbelt, A., & Seeley, W. P. (2007). Integrating art historical, psychological, and neuroscientific explanations of artists' advantages in drawing and perception. *P c 0 f Ae e c , C ea , a d e A , 1,* 80–90. http://dx.doi.org/10.1037/1931-3896.1.2.80

Kozbelt, A., Seidel, A., ElBassiouny, A., Mark, Y., & Owen, D. R. (2010). Visual Selection Contributes to Artists' Advantages in Representational Drawing. *P c 0 f Ae e c , C ea , a d e A , 4,* 93–102. http://dx.doi.org/10.1037/a0017657

Kraavanger, A. (2005). *Sec e d a ead* . New York, NY: Sterling Publishing Company.

Luquet, G. H. (2001). *C 0d e ' d a* . New York, NY: Free Association Books. (Original work published 1927)

Matthews, W. J., & Adams, A. (2008). Another reason why adults find it hard to draw accurately. *Pe ce , 37,* 628–630. http://dx.doi.org/10.1068/p5895

McCourt, M. E., & Olafson, C. (1997). Cognitive and perceptual influences on visual line bisection: Psychophysical and chronometric analyses of pseudoneglect. *Ne c 0 ca, 35,* 369–388709–3Tf3ut96)00143-1McManus, C., Chamberlain, R., Christopherson, C., Prince-Mobbs, L., Robinson, M., & Stelk, I. (2012). Six tea-towels, one calendar and 1659 children's self-portraits: A developmental study of children drawing faces. *Pe ce : ECVP Ab ac , 41*(Suppl.), 235.

Nguyen, H. T., Isaacowitz, D. M., & Rubin, P. A. (2009). Age- and fatigue-related markers of human faces: An eye-tracking study. *O - a0 0 , 116,* 355–36870964.3(http://dx.doi.org/10.1016/j.ophtha.2008.10.2096.N7.623596-2863o20.21Ostrofsky, J. (20