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A VISUOMOTOR SKILL MODEL FOR ARTISTS' ADVANTAGES IN DRAWING, VISUAL ANALYSIS, AND FORM RECOGNITION

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The art critic Roger Fry argued that the biological function of vision was to provide data for practical action (Fry, 1919). On Fry's account, familiarity and practical necessity cause the functional attributes of an object's appearance to become «labeled.» Once an object's attributes have been so categorized, perceivers cease to see it as it actually appears and attend instead to the labels identifying its functional properties. This entails that introspective access to the structure of appearances is constrained by the fact that practical knowledge «interferes» with perception, and so renders the actual structure of a visual stimulus «invisible» to the viewer. Fry argued that artists, in order to overcome these sorts of conceptual influences on the content of visual perception and recover the visual cues necessary for successful depiction, develop viewing strategies that enable them to attend to the structure of appearances independent of interference from practical knowledge of the shapes and functions of object types. Empirical evidence supports this claim. Kozbelt (2001) demonstrated that artists outperform non-artists both on drawing tasks and on form recognition tasks such as identifying the subjects of out-of-focus pictures. Partial correlational analyses further showed that artists' advantages in visual analysis are developed primarily to the extent that they are useful for drawing, suggesting a relationship between artists' drawing skill and visual advantage. We argue that these results can be explained by the way visuomotor skill operates in artists' methods to overcome top-down conceptual influences in object identification.

Kosslyn's (1995) model for object recognition leads us to hypothesize that specialized visuomotor skill enables artists to fix attention on details
of view-centered spatial maps of the locations of the image features that constitute the appearances of scenes and objects. In contrast, non-artists, who lack this skill, rely on object-centered representations of the generalized forms of objects and their parts. This model exploits a division of labor between two parallel information processing pathways in the visual system: a dorsal or «where» pathway subserving spatial location, and a ventral or «what» pathway subserving object identification (Milner & Goodale, 1995). The view-centered spatial maps of the dorsal stream are key to the motor skills necessary for human actions, like reaching, and so preserve particular, view-centered information concerning the spatial locations of objects and object parts at a particular time. In contrast, object-centered representations in the ventral system downplay particular, view-centered image features in favor of object-centered representations of general shapes of objects that facilitate recognition. Kosslyn argues that ordinary visual recognition exploits both types of spatial maps. According to his theory, object-centered representations are combined with view-centered maps of spatial locations in associative memory to form visual hypotheses about the structure and identity of perceived scenes and objects. If the outputs of these two systems are inconsistent, the visual hypothesis generated will favor information salient to the task at hand, e.g. identification versus action.

Artists' formal methods are a means for developing, and subsequently employing, specialized knowledge of the general structure of appearances. These formal methods exploit knowledge of those functional properties of an artworks' visible surface that support successful depiction, and consequently represent explicit strategies for identifying, or conceptualizing, scenes and objects as artworks (Gombrich, 1961). Therefore artists' formal methods utilize a novel class of practical knowledge that renders the ordinary appearances of object's and scenes themselves invisible, thus enabling artists to recover the visual cues necessary for successful depiction. This specialized knowledge is in turn joined to general problem solving heuristics and becomes efficiently proceduralized (Anderson, 1987) via the development of motor skills pertinent to particular media. We argue that, via the process of proceduralization, artists' explicit knowledge of the structure of appearances is encoded in motor maps specific to the visuomotor skill necessary for successfully manipulating a medium. Although these maps will differ with the skills required for a particular artistic medium (for instance, painting, drawing, or modeling), they will be directed at recovering the same set of local image features necessary for adequate depiction. Therefore, although we offer drawing as a paradigm example, our model can be generalized to other visual media.
Studies of grip-scale and size illusions in normal subjects and reaching abilities of visual agnosics demonstrate that dorsally-mediated visuomotor-responses do not fall prey to, and can be dissociated from, top-down influences of semantic knowledge in object identification (Milner & Goodale, 1995). Normal subjects who report being fooled by size illusions nonetheless scale their grips correctly when reaching for objects whose size they misreport. Further, DF, who suffers from visual form agnosia, can orient her hand in order to successfully insert a card into a slot, despite an inability to perceptually report the orientation of that slot. She is also able to scale her grip to the efficient grasp-points of asymmetrical objects indicating that, despite deficits in conscious form recognition, she can recover the principle axes defining an object’s generalized form. Milner and Goodale report that DF’s deficits are correlated with damage to the lateral prestriate cortex that deprives the ventral stream of all sources of visual input. They argue as a result that her intact abilities are subserved by dorsal processing, and that the spatial maps generated in the dorsal stream are sufficient for recovering gross formal properties of objects and scenes, such as their orientation and generalized form.

Further evidence in support of our hypothesis can be drawn from similarities between the slavish, point by point drawing style of patients suffering from associative visual object agnosia and the results of eye-tracking studies of skilled artists (Miall & Tchalenko, 2001). Patients suffering from associative visual object agnosia can make accurate copies of line drawings of familiar objects. However, due to brain damage interfering with ventral processing, these patients cannot match local image features to semantic knowledge of general object types and so cannot identify either the identity or global form of what they have accurately drawn. As a result, agnosics’ drawings are constructed piecemeal, via laborious point to point comparisons between the spatial locations of parts of local contours in the original and their copies (Farah, 2001). This latter fact is consistent with eye-tracking studies which indicate that skilled artists punctuate brief fixations with numerous saccades between the model and their drawings. Only after a number of these pointwise comparisons do they review the global characteristics of the contour that they have constructed and its relation to the rest of the drawing. This suggests that, as with visual agnosics, skilled artists drawing depends upon an ability to accurately recover local image features independent of attention to global image structure.

These four types of evidence suggest that, consistent with our hypothesis, motor proceduralization of explicit declarative knowledge of the structure of appearances can provide a viable mechanism to mediate the reduction
of conceptual interference in visual analysis and promote more accurate depiction in drawing. Kosslyn (1995) demonstrates that, in order to facilitate object identification, the visual hypotheses generated in associative memory access prior knowledge of the shapes and functions of general object types that in turn functions to prime the visual system, and shift attention to the location of expected objects or object parts. Our model suggests that, via specialized visuomotor skills, artists’ formal methods similarly exploit top down influence from motor priming in the construction of spatial maps in the dorsal (‘where’) pathway. Motor priming fixes artists’ attention on salient image features that are necessary for accurate depiction, such as contours that demarcate areas of high contrast or texture gradients that suggest depth via shading in drawing tasks. This effectively screens out the interfering influence of background knowledge of object features in recognition. Therefore we hypothesize that in addition to background knowledge of the shapes and functions of objects, motor priming contributes top down to recognition and accounts for skilled artists advantages in visual analysis.

References


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648