

A Visuomotor Model for Energetic Costs Effects in Picture Perception

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The spatial metric of perception is influenced by the energetic costs of anticipated actions (Proffitt, 2006). The slopes of hills appear steeper and distances to targets appear longer when agents are encumbered by a heavy backpack or tired after a long run. These effects generalize to picture perception (Seeley, forthcoming). Exaggerations of slope and distance in line drawing copies of paintings are correlated with changes in the interpreted energetic costs of depicted actions. Witt and Proffitt (2008) have demonstrated that motor simulation is the mechanism supporting energetic costs effects in ordinary perceptual contexts. Kozbelt and Seeley (2007) argue that motor simulation accounts for correlations between drawing skill and performance in visual analysis and form recognition tasks (Kozbelt 2001). Kozbelt and Seeley argue that reciprocal connectivity between premotor areas involved in motor preparation and prefrontal areas involved with spatial working memory and selective attention facilitate seeing the world in terms of affordances for actions. Energetic costs effects suggest that this model generalizes to other types of motor skills and actions.

This explanation for energetic costs effects in picture perception is consistent with, and so lends support to, participant accounts of narrative understanding. Participant accounts argue that first person perspective taking plays a significant role in narrative understanding: in engaging with a narrative, spectators, readers, and listeners adopt the beliefs and desires of characters and simulate critical aspects of depicted actions. Several lines of evidence support a role for motor simulation and action planning in picture perception. Areas of the early visual cortex associated with motion perception are engaged by the perception of abstract motion cues in static images (Kourtzi & Kanwisher, 2001). Motion after effects have been observed for biological motion depicted in static images (Winawer et al, 2007). Processing time influences perceived direction of motion in apparent motion displays depicting biologically possible actions

(Shiffrar & Pinto, 2002) and the perception of biologically possible motion paths is correlated with selective activation of motor areas associated with the performance of the depicted actions (Stevens et al, 2000). These data suggest that premotor areas involved in the simulation and the performance of particular actions are involved in the perception and understanding of dynamic events depicted in static images.

We review these data (Seeley, forthcoming) and propose a visuomotor model for energetic costs in picture perception. We argue that motor simulation plays a complimentary role in narrative understanding and visual attention that accounts for the influence of the energetic costs of actions on apparent slope and distance in static images that depict dynamic events. We argue that this model generalizes to ordinary perceptual contexts, demonstrating that the relationship between perceptual psychology and empirical psychology is a two way street.

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