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IS THERE AN INDEPENDENT PLANNING SYSTEM? SUGGESTIONS FROM A DEVELOPMENTAL PERSPECTIVE

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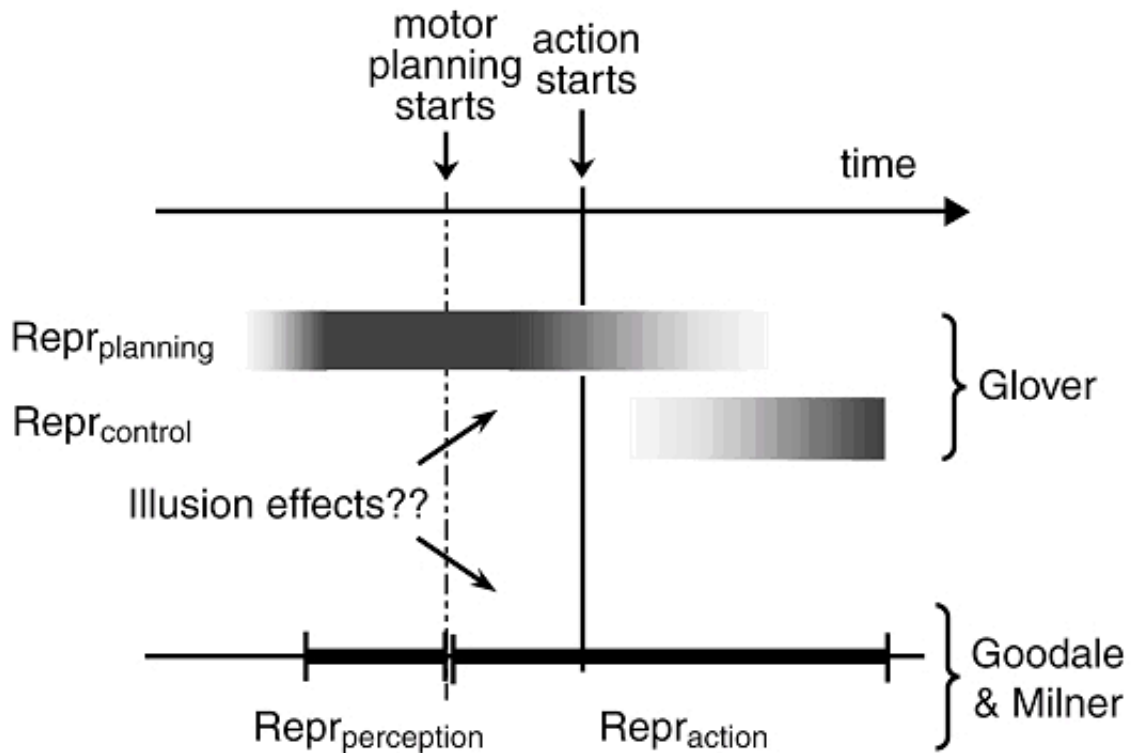
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Abstract: Glover argues that separate representations underlie the planning and the control phase of actions and contrasts his model with Goodale and Milner's perception/action model. Is this representation indeed an independent representation within a more general action system, or is it an epiphenomenon of the interaction between the perception/action systems of the Goodale – Milner model?

We contrasted the Glover and the Goodale – Milner models in Figure 1. According to our understanding, one of the main differences between them is the way they conceptualize the representation that the motor program is based on. In the Goodale - Milner model, it is the 'action' representation of the dorsal stream ($\text{Repr}_{\text{action}}$); while in Glover's model, it is a representation underlying the planning phase ($\text{Repr}_{\text{planning}}$).

The two models disagree about the potential effects of visual context on this representation. According to Glover's model, context has a potentially large effect on $\text{Repr}_{\text{planning}}$, while in the Goodale - Milner theory it does not (or the effect can only be small). Glover also claims that $\text{Repr}_{\text{planning}}$ determines certain

parameters of the motor program, such as lifting force, posture choice, movement time and grip acceleration and these parameters can be strongly influenced by illusion effects (see Chapter 2.6.1.). Not all motor program parameters are under the control of $Repr_{planning}$: some, such as maximum grip aperture and pointing accuracy are driven by $Repr_{control}$, and these are the parameters that context-induced illusions do not influence.



We propose an experiment motivated by our recent developmental studies that could significantly contribute to this issue. We have studied four-year-old children's and adults' performance in a 2AFC version of the Ebbinghaus illusion (Titchener circles) task (Káldy & Kovács, 2003; see also Kovács, 2000). Both children and adults were asked to decide which one of the target circles amidst the context circles appeared larger. The task was entirely perceptual, that is, no action was required toward the target circles. Our results have shown that the magnitude of the illusion effect was significantly smaller in children than in adults, and our interpretation is that visual context integration is not fully developed in 4-year-olds. In terms of the Goodale - Milner model, we found an age-dependent effect of the magnitude of the context-induced illusion on $Repr_{perception}$. We proposed earlier that the ontogenetic development of the dorsal 'action' system is faster than that of the ventral 'perception' system in humans (Kovács, 2000). Based on the age dependent illusion effect on $Repr_{perception}$, and on the faster maturation of the 'action' system, we suggest an experiment that could decide about the independent existence of the 'planning' system in Glover's model. As Glover suggests, there are particular parameters of movement that seem to be affected by illusions because they are determined by $Repr_{planning}$. Movement time as measured in the Ebbinghaus illusion is one of those parameters (van Donkelaar, 1999). Taking into account the faster maturation of planning related areas, the Glover model would predict that children should demonstrate adult-like illusion effects in terms of movement time well before they do in the perceptual version of the Ebbinghaus illusion task. However, the Goodale - Milner model, in the strict sense, does not allow for illusion effects arising from the 'action' system, therefore the origin of the illusion should be in $Repr_{perception}$. In this case, young children should

behave the same way as in the perceptual task: they should demonstrate much smaller illusions than adults. This test would be an interesting way to study the relationship between the two hypothetical concepts, $Repr_{planning}$ and $Repr_{perception}$, and the controversial period before the action starts.

References

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