Commentary on J. Kevin O'Regan and Alva Noë (A sensorimotor account of vision and visual consciousness)

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# In Search of the Ultimate Evidence: The Fastest Visual Reaction Adapts to Environment, not Retinal Locations

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## Abstract

The sensorimotor account of perception is akin to Gibsonian direct realism. Both emphasize properties of world challenging views based on the analysis of internal visual processing. To compare the role of distal and retinotopic parameters, distractor effect, an optomotor reaction of a midbrain origin, is considered. Even in this case, permanence in environment not on retina explains the dynamics of habituation.

The target article presents a refreshing synthesis of hitherto separated research but it also creates a déjà vue impression. Every 40 years, somewhere in the world, there is a rebellion against passive, mirror-like theories of cognition. For instance, a sensorimotor treatment of perception was the established view in Russian activity psychology (see Velichkovsky, Luria & Zinchenko, 1973). In the 60s, labs around Leont'ev and Luria tried to implement ideas of activity-based approach to perception and even to find eye movements (presumably in the tremor range), which could explain color perception, however -- then -- without much success.

We describe data relevant to the world-as-its-own-model hypothesis. Is there a neurophysiological transition from proximal to distal representations? In line with Gibsonian argumentation, O'Regan and Noë deny the relevance of such a transition. These arguments are not always conclusive. All phenomena considered by O'Regan and Noë involve cortical processing that can include one or rather several transitions from retinotopic to spatial coordinates - it is simply tempting to relate them to phenomenal perception.

Of interest is therefore a phenomenon that is much simpler. This distractor effect (also 'remote distractor effect') refers to an inhibition of a saccade or -- what is the same in a free visual exploration -- to a prolongation of the current fixation after a sudden visual event (Levy-Shoen, 1969; Walker, Deubel, Schneider & Findley, 1997). With its reaction time of only 100 msec, distractor effect is the fastest optomotor reaction in humans. This effect is also evoked by acoustic signals, so it could be related to orienting reaction (Pannasch, Dornhoefer, Unema & Velichkovsky, in press).

As a symptom of orienting reaction the effect should habituate -- but there was no sign of a habituation in our experiments. One possible reason is that we used gaze-contingent paradigm presenting distractors in the same area of retina. In a new experiment, we compared distrators' efficiency over time when they appear either in the same retinal location (variable localization in the world) or in the same place of the picture (variable retinal location). Full-screen copies of 19s century paintings were presented to the subjects on a 17' computer monitor with instruction to study them for a recognition test. After the initial phase of 20 sec, distractors (circular patterns of 4 degrees diameter) appeared within approximately every 7th fixation. Distractors were presented for 75 msec either in the lower right part of the picture, 12 degrees from the center, or in the respective location of visual field. In addition, they were presented 50 or 150 msec after begin of fixation. After 12 distractors, the picture was replaced by the next. Conditions were partially counterbalanced across 6 subjects and 4 pictures.

Fig.1 shows main results. No effect is observed either in space or in retinal coordinates for 50 msec delay. For 150 msec and permanent localization in the picture, there is a clear distractor effect as well as two habituation effects -- between pictures [$F(3,6)=6.29$, $p<.001$] and between first 6 and last 6 distractors within the first three pictures [$F(1,6)=5.82$, $p<.024$]. In the case of the same retinal location, there is a significant distractor effect [$F(1,6)=11.48$, $p<.001$], however it does not change over time.

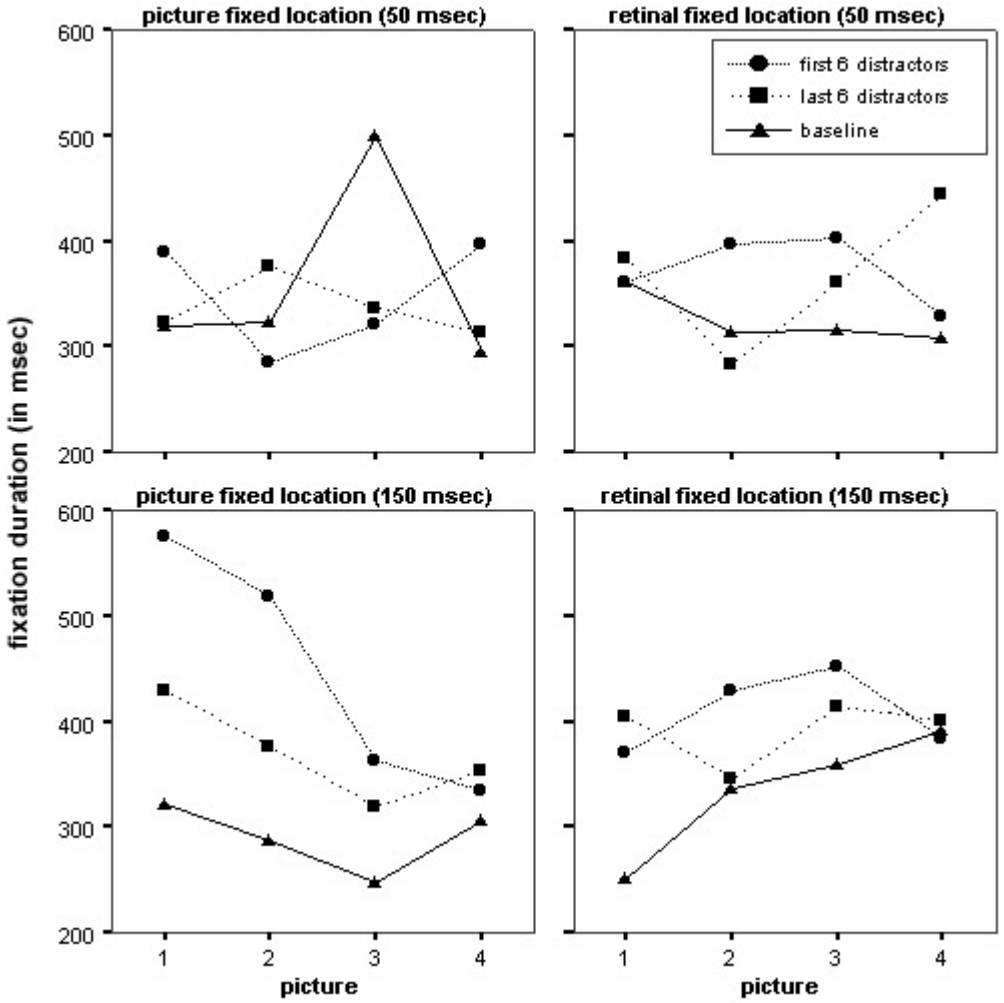


Figure 1. Fixation duration for the first vs. last distractors and the baseline: (a) distractors appear 50 msec after begin of fixation in the same picture location, (b) 50 msec delay, same retinal position, (c) 150 msec delay, same picture location, (d) 150 msec delay, same retinal position.

According to a recent analysis, distractor effect seems to be mediated by midbrain optomotor circuits (Reingold & Stampe, 2000). They are retinotopically organized and too fast for an involvement of higher-level representations. Our results demonstrate that even in this case the permanence in space, not on retina causes the decline in the saccadic inhibition. The decline can be explained by a genuine habituation or by a form of adaptation mediated by sensorimotor activity: distractors with an invariant position in the world are easier explored and sooner lose their novelty. Of interest is that adaptation effects are observed only at longer delays. This fact testifies that the environmental dependency is due not to an immaterial symbolic act. Rather, every re-fixation initiates the process of spatial localization anew and the process obviously needs some time to be completed (Bridgeman, Van der Heijden & Velichkovsky, 1994). Remarkable is the generality of this process, its potency across the vast range of brain's evolutionary mechanisms.

# References

Bridgeman, B., Van der Heijden, A. & Velichkovsky, B.M. (1994).A theory of spatial stability across

saccadic eye movements. Behavioral and Brain Sciences, 17(2), 247-292.
Lévy-Schoen, A. (1969). Détermination et latence de la réponse oculomotrice à deux stimulus. L'Année Psychologique, 69, 373-392.
Pannasch, S., Dornhoefer, S., Unema, P. & Velichkovsky, B.M. (in press). The omnipresent prolongation of visual fixations. Vision Research.
Reingold, E. & Stampe, D. (2000). Saccadic inhibition and gaze contingent research paradigm. In: A. Kennedy, R. Raddach, D. Heller & J. Pynte (Eds.) Reading as perceptual process. Amsterdam: Elsevier.
Velichkovsky, B.M, Luria, A.R. & Zinchenko, V.P. (1973). Psychologia vospriatia [Psychology of perception]. Moscow: Moscow University Press.
Walker, R., Deubel, H., Schneider, W.X. & Findlay, J.M. (1997). Effect of remote distractors on saccade programming. Journal of Neurophysiology, 78, 1108-1119.

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