

REVIEW

of the PhD thesis of Kiril Borislavov Kostov, MS, titled:

The Handle Orientation Effect:

Critical attentional factors that have received little to no attention

The thesis is an extensive critical study of the controversial results related to the influence of task irrelevant characteristics of an object, e.g. its handle orientation, to the reaction times in manual motor responses, related to the paper of Tucker & Ellis (1998). The main effects considered in this field are the faster responses subjects give when the stimulus location corresponds to the response location (e.g. right-hand – stimulus on the right side) compared to the situation when the stimulus does not correspond to it (e.g. right hand – stimulus on the left side). In the literature, the explanation of this effect is often based on spatial coding of the stimulus appearance and the effect is called Stimulus-Response Compatibility (SRC).

The focus of the thesis is on the study of how low-level perceptual characteristics and attentional exogenous factors, related to the horizontal position of the stimuli and their asymmetry interact with the handle orientation and RSC effects or can account for the results in the literature attributed to them.

The extensive literature review presents very clearly the traditional accounts of the phenomenon – the motor (or affordance) and the spatial compatibility (or the Simon)

effects. It pays also special attention to various attentional mechanisms accounting for the above effects.

The thesis provides an extensive critical presentation and discussion of the disagreement between various authors on the extent, to which grasping affordance or spatial compatibility may contribute to stimulus-response compatibility effects. The theoretical analysis based on the existing literature emphasizes the possible role of attention and more specifically low-level visual features in SRC phenomena and is a contribution by itself. This analysis provides the needed basis for the focus of the thesis, namely the role of exogenous attention and specific aspects of it that have not received sufficient attention in the literature so far.

The thesis presents the results of six experiments, which follow from the review and analysis of the literature and answer a cascade of research questions. The experimental designs and procedures show a very rigorous approach, which is completely justified with respect to the small differences in reaction times measured. It consisted of discarding subjects who have exceeded a threshold for the response error rate. The stimulus material is of good quality and corresponds to the goals of each experiment.

In Experiment 1, a handle-orientation effect was not found but only SRC with respect to the location of a colored marker on realistic photographs of objects. In Experiments 2 and 3, which are at the core of the thesis, form processing was expected and therefore handle-orientation effects. Instead, negative compatibility effects are observed, as the responses were faster with respect to compatibility with the bodies and not with respect to the handles of the presented graspable objects. These results are at odds with similar previous studies in a variety of tasks and their understanding is the goal of Experiment 4, 5, and 6.

The author identifies a potential account of these observations in the lack of control of the horizontal positioning of the stimuli and the importance of area-centering and width-centering, previously brought to attention in the existing literature. As pointed out in the thesis, in the case of highly asymmetrical stimuli, neither of these methods provides a satisfactory setting for studying handle orientation effects, as area-centering leads to strongly lateralized handles, and width-centering to more pixels in the body part of the objects. In Experiment 3, width-centered stimuli lead to body-related compatibility effects, while in Experiment 4, area-centered stimuli lead to handle-related compatibility effects. This effect is further demonstrated in Experiment 5 (where only silhouettes of objects are presented to eliminate any grasping influences) in which results similar to the results of Experiments 3 and 4 are obtained. Experiment 6 confirms the findings of the previous 4 experiments with smaller stimuli.

Based on these findings, the explanation suggested in the thesis is that the results of Experiments 2-5 can be related to exogenous attention shifts in response to low-level visual salience, making any higher-level factors questionable. Thus, the main claim of the thesis is that previous studies may have mistakenly identified grasping affordance effects instead of low-level perceptual ones based on attentional shifts. The experiments convincingly demonstrate that horizontal positioning in the case of shape asymmetry modulates the direction and magnitude of SRC effects in various stimulus and task variations – detailed pictures vs. silhouettes, and color-processing vs. shape-processing tasks. In my opinion, this is an important methodological contribution of the thesis.

The conclusions of the thesis, which make questionable many result interpretations existing in the literature on SRC, are based on high quality data and adequate statistical analyses. These analyses include repeated measures ANOVA,

Newman-Keuls post-hoc comparisons, Sternberg's additive factor logic analysis and distributional analysis.

Kiril Kostov demonstrates an excellent knowledge and research skills is able to apply them to discover and discuss potential problems in a research that has been done for many years. Thus, the results presented in the thesis are an important contribution to an important research problem and demonstrate the capability of the author to initiate, carry out, and complete complex experimental studies based on excellent understanding of previous research, and existing theoretical explanations.

The contributions are clearly stated in the thesis and I am fully convinced of the importance of the experimental findings, the presented analyses and discussion, and their relevance for this research domain. I agree with the author that the main contribution of the thesis are the results of Experiments 3 and 4 which demonstrated that both the width-centered and area-centered presentation of highly asymmetrical stimuli are inadequate in avoiding spatial compatibility effects. These results make the interpretation of the results of many publications in the field uncertain.

Another important contribution of the paper is the detailed analysis, which shows the possible co-existence of two Simon effects, related to the width-centered and the area-centered conditions with different time courses as evidenced by the performed bin analyses. In the width-centered condition, the Simon effect is more stable for various RTs while in the area-centered one, it increased with increasing reaction times. According to the author, the latter suggests that shape-based Simon effects may be different from location-based effects, which typically decay with larger RTs. All these results support the attentional shift account for the Simon effect promoted in the thesis.

The extended abstract of the thesis provides a more concise but comprehensive presentation of the work and contributions of the thesis and confirms the maturity of the

presented ideas and research methodology. I would like to recommend to the author a publication in a major psychology journal encompassing the main results of the thesis as they have the potential to have an important impact in its area of research.

I would like to emphasize my satisfaction with the quality of the research presented in the thesis, which is an excellent example of scientific curiosity and a drive to understand as much as possible of an observed phenomenon combined with clear, consistent and self-sufficient presentation.

I have some minor technical remarks. Most of the tables in the text are not centered. There should be a space between the values and the units. There are also some minor omissions.

As a more general comment, I think that it would have been interesting to include stimuli, which are area-centered without being asymmetric and with a handle like a kettle, jug, or knife and look for handle-orientation effects. Such stimuli would provide a direct check of the existence of handle affordance effects whose existence seems questionable in the light of the results of the thesis.

Kiril Kostov has co-authored two papers published in *Cognitive Processing*, a journal with impact factor, which have been cited 8 times according to Google scholars. He has presented his results at several departmental seminars and twice at the International Conference on Spatial Cognition, Rome (in 2012 and in 2015). The extended abstract of the thesis is in a ready for publication state, so I consider the publications behind the thesis and the potential for future publications up to the requirements for a PhD thesis.

I know Kiril Kostov since his studies in the Cognitive Science MS program at NBU and as a colleague during his PhD studies. I have attended several seminars given by him and have no doubts about the independence of his work and his personal

contributions at all levels of the presented research. In my opinion, Kiril Kostov has become an accomplished researcher over the years and I confidently look forward his future achievements.

Based on the quality and contributions of this thesis, I am fully convinced that Kiril Kostov deserves to be awarded a PhD degree in psychology.

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