Interference of Mechanical Knowledge with Tool Function Perception

Ioanna Zhazhkova

Supervisor: prof. dr hab. Grzegorz Króliczak

When one perceives a tool (defined as any handheld physical object that enhances the user's sensorimotor capabilities), several kinds of knowledge may be invoked. For instance, *functional* knowledge is information that is commonly associated with the tool, such as the contexts in which it is used or the objects with which it is used. E.g., keys are generally meant to be put into keyholes and turned in order to open or close a door. *Mechanical* knowledge, on the other hand, concerns the intuition one has about the tool's physical properties and potential actions in which it can be used. E.g., a stone is hard and heavy, so it may be used as a weight, as a weapon, to hammer a nail, or to break something. Functional knowledge (which invites the "obvious" usage) can sometimes interfere with mechanical knowledge (which enables the "creative" usage), obstructing problem-solving processes. This phenomenon, called functional fixedness, has been studied since as far back as the 1930s.

However, the question of whether the reverse process (mechanical knowledge interfering with functional knowledge) can occur has not yet been definitively resolved. There is evidence that recent learning experiences can bias the search for alternative uses of a tool. Considering this, the future study will attempt to use generative learning in order to create a situation where functional knowledge is required but may be inhibited in favour of mechanical knowledge.

Participants will be required to choose the best tool to solve a simple problem in four subsequent (though not directly consecutive) conditions. The trials will feature three types of tools in relation to the problem (e.g., opening a door): 1) the "*obvious*" tool to solve the problem, which reflects functional knowledge (e.g., a key), 2) the "*unusual*" tool, which reflects mechanical knowledge (e.g., a hammer), and 3) the "*impossible*" tool, which cannot be used in this particular situation (e.g., a toothbrush). In the first (baseline) condition, the participants will be choosing between the "obvious" and the "impossible" tools. Secondly, the "obvious" and the "unusual" tools will be shown (this condition was introduced in order to balance the number of presentations for each stimulus). In the third condition, the choice will be limited to the "unusual" and the "impossible" tools, prompting the participant to focus on the unobvious tool to use. The last condition will be identical to the second ("obvious" vs "unusual"). Behavioural and eye-tracking measures will be analysed to assess the occurrence and extent of interference.

The main expectations concern reaction time and overall fixation duration. In the first and second conditions, the solution will be clear, so the shortest reaction time and fixation duration are hypothesised. In the third condition, the limited choice of tools is thought to cause the longest trial and fixation duration. In the fourth condition, reaction time and fixation duration are expected to be significantly longer compared to the second trial (although the stimuli will be the same), because the problem-solving process will be biased towards the "creative" solution.

The study will explore whether recent learning experience focusing on mechanical knowledge is able to interfere with the access to functional knowledge, as well as add to the evidence on the distinction between these two types of knowledge.