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**WHAT ABOUT MECHANICAL KNOWLEDGE?**

Comment on “Action semantics: A unifying conceptual framework for the selective use of multimodal and modality-specific object knowledge”

by van Elk, van Schie, and Bekkering

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**RUNNING HEAD: WHAT ABOUT MECHANICAL KNOWLEDGE?**

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### **WHAT ABOUT MECHANICAL KNOWLEDGE?**

A significant body of literature has shown a strong association in left-brain damaged patients between familiar tool use and the use of novel tools to solve mechanical problems [1-6; see also 7-9], suggesting that any tool-use situation might require mechanical knowledge. This knowledge, which is thought to be non-declarative, contains information about the physical actions of the world (e.g., gravity, lever, percussion). Damage to the left inferior parietal lobe has been associated with impaired mechanical knowledge [2,7].

By contrast, patients with selective semantic deficits for usual functions of tools (e.g., knowing that a hammer is usually used with a nail and can be found in a workshop) due to anterior temporal lobe lesions (e.g., semantic dementia) can use correctly tools and objects when presented together in a clinical context or in everyday life [e.g., 10-11] as well as to use novel tools to solve mechanical problems [12-13]. These results indicate that “semantic” knowledge does not support tool use per se. Interestingly, difficulties can appear in single tool use situations, namely, when tools are presented in isolation [11,13]. One possible interpretation is that semantic knowledge is fundamental for single tool use in order to determine in which context the tool is usually used. However, spared mechanical knowledge can be sufficient to infer how to use a tool with its corresponding object when presented together.

These findings question the theoretical framework of van Elk et al. [14] for three reasons. First, they do not formulate any clear distinction between what we call “mechanical” and “semantic” knowledge, as if the term “function” could be associated with either “utilization” or “usage” (as in their example of the tent pegs; for discussion on this aspect, see [8-9,11]). Second, in their framework, anterior temporal lobe lesions

should lead to important tool use disorders, whatever the situation of use. Third, the aforementioned studies suggest that the left inferior parietal lobe is not central to “procedural” or “manipulation” knowledge (i.e., information encoding egocentric, body-tool relationships) but rather to mechanical knowledge (i.e., information encoding allocentric, tool-object relationships).

To end, van Elk et al. [14] assume that their “control hierarchy” system based on prefrontal structures allows the flexible use of tools. However, evidence demonstrates that mechanical problem solving skills are not associated with prefrontal lobe lesions or dysexecutive syndrome [1-6,15]. Therefore, mechanical knowledge might be the cognitive basis for the flexible use of tools. In other words, contrary to what van Elk et al. propose, all tool-use situations would require reasoning on the basis of the current user’s intentions, thereby ruling out the idea that in some cases “functional” or “manipulation” knowledge can be directly activated, without any intention.

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#### **REFERENCES**

- [1] Goldenberg, G., & Hagmann, S. (1998). Tool use and mechanical problem solving in apraxia. *Neuropsychologia*, 36, 581-589.
- [2] Goldenberg, G., & Spatt, J. (2009). The neural basis of tool use. *Brain*, 132, 1645-1655.

- [3] Hartmann, K., Goldenberg, G., Daumüller, M., & Hermsdörfer, J. (2005). It takes the whole brain to make a cup of coffee: The neuropsychology of naturalistic actions involving technical devices. *Neuropsychologia*, 43, 625-627.
- [4] Jarry, C., Osiurak, F., Delafuys, D., Chauviré, V., Etcharry-Bouyx, F., & Le Gall, D. (2013). Apraxia of tool use: More evidence for the technical reasoning hypothesis. *Cortex*, 49, 2322-2333.
- [5] Osiurak, F., Jarry, C., Allain, P., Aubin, G., Etcharry-Bouyx, F., Richard, I., Bernard, I., & Le Gall, D. (2009). Unusual use of objects after unilateral brain damage: The technical reasoning model. *Cortex*, 45, 769-783.
- [6] Osiurak, F., Jarry, C., Lesourd, M., Baumard, J., & Le Gall, D. (2013). Mechanical problem-solving strategies in left-brain damaged patients and apraxia of tool use. *Neuropsychologia*, 51, 1964-1972.
- [7] Goldenberg, G. (2013). *Apraxia: The cognitive side of motor control*. Oxford: Oxford University Press.
- [8] Osiurak, F., Jarry, C., & Le Gall, D. (2010). Grasping the affordances, understanding the reasoning. Toward a dialectical theory of human tool use. *Psychological Review*, 117, 517-540.
- [9] Osiurak, F., Jarry, C., & Le Gall, D. (2011). Re-examining the gesture engram hypothesis: New perspectives on apraxia of tool use. *Neuropsychologia*, 49, 299-312.
- [10] Buxbaum, L. J., Schwartz, M. F., & Carew, T. G. (1997). The role of memory in object use. *Cognitive Neuropsychology*, 14, 219-254.
- [11] Osiurak, F., Aubin, G., Allain, P., Jarry, C., Richard, I., & Le Gall, D. (2008). Object usage and object utilization. A single-case study. *Neurocase*, 14, 169-183.
- [12] Hodges, J. R., Spatt, J., & Patterson, K. (1999). "What" and "how": Evidence for the dissociation of object knowledge and mechanical problem-solving skills in the human brain. *Proceeding of the National Academy of Sciences of the United States of America*, 96, 9444-9448.
- [13] Hodges, J. R., Bozeat, S., Lambon Ralph, M. A., Patterson, K., & Spatt, J. (2000). The role of knowledge in object use: Evidence from semantic dementia. *Brain*, 123, 1913-1925.
- [14] van Elk, M., van Schie, H., & Bekkering, H. (in press, this issue). Action semantics: A unifying conceptual framework for the selective use of multimodal and modality-specific object knowledge. *Physics of Life Reviews*.
- [15] Goldenberg, G., Hartmann-Schmid, K., Sürer, F., Daumüller, M., & Hermsdörfer, J. (2007). The impact of dysexecutive syndrome on use of tools and technical devices. *Cortex*, 43, 424-435.