NAME OF THE AUTHOR (S) OF THE TARGET ARTICLE:
Christophe Heintz and Thom Scott-Phillips

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The evolutionary roots of goal-directed mechanisms: A communication account.

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ABSTRACT:

Unleashed expressions for cooperation are mainly based on the expected perceptual effects of behaviours and not the behaviours themselves. From an evolutionary viewpoint, this goal-directed mechanism allows for a comprehensive story for the theory proposed by Heintz and Scott-Phillips. Over the past 2 million years, this situated mechanism has been reused for tool use and the language development for hominids.

MAIN TEXT:

Similar to art, tool use and language, cooperation-communication from unleashed expressions represents a defining feature of human species. This fundamental issue was very well embraced by Heintz and Scott-Phillips in their suggestion that human communications

come from an interrelated collection of cognitive capacities devoted to the expression and recognition of informative intentions. The goal of such cognitive capacities is social adaptation in human cooperation. For example, the recognition and interpretation of body movements of others can form human expressions and the core of shared human interactions. In teaching situations, such as dance learning, the teacher can trigger unleashed expressive behaviours to deliver her or his message to the learner. I agree with this role of unleashed actions for cooperation, but the described predictive behaviour mechanism underlying such communication is misinterpreted and lacks two essential prerequisites: grounded cognition and neuronal-reuse mechanisms.

The main delusion of the target article comes from the assertion that human communication and cooperation should come from only the understanding of bodily states, and not from the expected perceptual effects of these movements (Badets, Koch, & Philipp, 2016; Kunde, Weller, & Pfister, 2018). In this view, it is important to emphasize that such communication comes from a grounded mechanism and, more precisely, a situated account. For Wilson (2002), cognition involves perception and action mechanisms, but it crucially includes the context of a real-world environment. From this perspective, perceptual information from the environment and generated from actions themselves support online cognition, especially for humans while holding a conversation (see also Barsalou, 2008). Accordingly, Pickering and Garrod (2013) suggested that, during a dialogue between two persons (A and B), there is a shared cognition between the perceptual information about the speech during the production of words-sequences (language production by A) and the processed information during the understanding, from a semantic level, of these words-sequences by B. For this perceptual-alignment hypothesis, the expected perceptual effect of mouth movements should represent the cognitive base in which expected information from the environment can be updated for human interaction. For unleashed communication, the best anticipative tool that humans possess is a goal-directed mechanism devoted to the processing of relevant expected perceptual effects. Consequently, for communication and cooperation, bodily states could play only a subordinate role.

For a semantic processing account and to dissociate body movements from their generated-expected perceptual effects, we recently developed a paradigm that manages a tool-use task during Arabic number processing (Badets and colleagues, 2017, 2020). In these experiments, participants were required to use inverse pliers, such as French snail pliers, after the processing of small or large numbers. Respectively, such number presentations allow for the processing of a small or large magnitude dimensions that could interact with the movements

of the pliers. Specifically, two hypotheses can be supported. First, if small and large number processing efficiently prime the hand movement towards the tool, then faster movements should be observed for the closing and opening hand movements. According to this view, closing and opening movements of the hand correspondingly implicate an opening and closing movements of the pliers towards the object that are not relevant for the interaction. Second, if the pliers' movements are more essential during this task, then the interaction with numbers should be observed with the pliers' movements independent of the hand movements. The results confirmed this second hypothesis in revealing that the large number processing slowed the action to perform the closing movement with the tool and, as a result, the opening movement of the hand. Here, the interaction between a person and her or his environment does not come from body movement itself but from the expected perceptual effects of these movements, here the tool action.

From an evolutionary point of view, this tool-semantic interaction reinforces the hypothesis that human cooperation-communication and tool use developed in a conjoint manner, starting approximately 2 million years ago (Larsson, 2015). According to this theory, producing and perceiving sounds created by tool use could have played a crucial role in the development of semantics and communication in humans. For a complete description of this mechanism, Badets and Osiurak (2017) suggested that such an anticipative system has been reused during human evolution. For these authors, "a fundamental principle of the human brain is to recycle an old inherited brain network to permit adaptations to new social and/or environmental constraints" (p. 367). For Anderson (2010), it is indeed more efficient for the brain to reuse an existing neuronal area for new tasks than to evolve new networks. Consequently, to construct or to use a tool, it is highly probable that the sounds of tools have, from an evolutionary viewpoint, constituted the core perceptual information for unleashed human expressions in communication and cooperation. This perspective is speculative but posits the goal-directed mechanism for communicative acquisition for a more representative story in human evolution.

Obviously, it could be argued that claiming that human communication and tool use have evolutionarily emerged conjointly (see also Corballis 2013) affords an interesting hypothesis but lacks convincing detailed cognitive mechanisms. However, I draw attention in the commentary that a well-documented perceptual mechanism (Shin, Proctor & Capaldi, 2010), and not a body movement mechanism, could characterize a common denominator between the two intertwined domains. Accordingly, during a dialogue, the understanding of the perceptual information of sound sequences could form the shared cognition between two

persons. From an evolutionary perspective, it has been easier to reuse sounds of different tools for the emergence of such relevant perceptual information (Larsson, 2015). This goal-directed mechanism could represent the common denominator between tool use and communication and afford a more complete story of the unleashed theory suggested by Heintz and Scott-Phillips. From this perspective, we could argue that only humans are capable of vocally describing, with great and unleashed details, how they will use a tool to manage future cooperation in real-life episodes. Here, the situated account and the neuronal-reuse mechanism represent indispensable notions for a plausible evolutionary theory.

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