Abstracts

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What is special about intentional action?

There is something intuitively sound in the idea that intentional actions are brought about by the psychological states we are aware of, such as desires, beliefs or plans. This notion also spawns important ethical and societal issues. In particular, in holding somebody accountable for the consequences of his or her behaviour, we reason under the overall assumption that people's actions match, to a certain extent at least, the psychological states they endorse. It is such a match that seemingly guarantees that people are able to control the actions they carry out. However, findings in the cognitive neuroscience of action have cast doubt both on the explanatory relevance of psychological states and on people's subjective ability to introspect upon them. According to some radical views, conscious psychological states might be reducible to biochemical afterthoughts. Are we thus acting coherently in the way we normally assess people's behaviour? I will discuss the plausibility of two potential positive answers to this question. One view maintains that knowledge about the mechanistic bases of intention and action is ultimately irrelevant because it cannot have any long-lasting impact on the way we deal with interpersonal interactions and responsibility attributions, e.g. in any case, we could not prevent ourselves from holding people accountable. The other view, which I will defend, directly engages with science, aiming at carving out an empirically acceptable model of how people are able to control their actions and can be held accountable for them.

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Metacognition and freedom of choice: introspecting the cause of our actions

What do we know about the factors that influence our decisions? Are we aware of the true reasons of our 'free' choices? The ability to introspect the origin of our choices constitutes a key metacognitive function but little is known of the cognitive process and neural substrate that underlie our sense of freedom of choice.

It has been proposed that when faced with a free choice in the absence of external evidence, the brain might use endogenous noise to break the symmetry between different options, and decide how and when to act. However, the specific mechanisms that underlie such free decisions remain unclear. Which cognitive processes determine the influence of endogenous and exogenous signal used to form free decisions? And can we actually introspect how much our decision are based on each of these two sources, evaluating our true freedom of choice?

In this series of studies, we investigated the brain mechanisms underlying objective and subjective freedom of choice in decision making. In particular, our aim was to determine what are the neural substrates enabling us to detach from sensory affordances and rely on internal signal to make free choices. To do so, we used a novel paradigm that estimated how human decisions were influenced by minor fluctuations in a visual signal that either cued a decision, or left participants free to decide for themselves. By varying the clarity of these cues, we were able to investigate both how fluctuating sensory information could influence action selection processes, and also participants' awareness of such influence.

Our results revealed three novel findings. First, sensory input biased "free" selection between alternative actions even when participants are trying to detach from it. Second participants remained unaware of that influence. Third, participants mistook opposing incoming perceptual information for being more free. Taken together, these results provide evidence that the cognitive mechanisms involved in actual sensory detachment and the sense of freedom of choice partially dissociate, providing evidence consistent with limited ability to introspect the origin of our actions.

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Is volition conscious?

Volition refers to a capacity for endogenous action, particularly goal-directed endogenous action, shared by humans and some other animals. It has long been controversial whether a specific set of cognitive processes for volition exist in the human brain, and much scientific thinking on the topic continues to revolve around traditional metaphysical debates about free will. At its origins, scientific psychology had a strong engagement with volition. This was followed by a period of disenchantment, or even outright hostility, during the second half of the twentieth century. In this review, I aim to reinvigorate the scientific approach to volition by, first, proposing a range of different features that constitute a new, neurocognitively realistic working definition of volition. I then focus on three core features of human volition: its generativity (the capacity to trigger actions), its subjectivity (the conscious experiences associated with initiating voluntary actions), and its teleology (the goal-directed quality of some voluntary actions). I conclude that volition is a neurocognitive process of enormous societal importance and susceptible to scientific investigation.

Liad Mudrik

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Volitional action and consciousness: what we know, and what we want to know

In the last decades, questions about free will or consciousness - once considered outside the scope of empirical science - have became part and parcel of cognitive neuroscience. To meet the challenge of scientifically operationalizing these questions, different experimental manipulations have been developed. In this talk, I will argue that these operational definitions play a critical role in shaping the questions we ask and the conclusions we reach. I will first demonstrate that with respect to the widely studied readiness potential, and claims about consciousness role in volitional action (or lack thereof). Then, I will turn to other functions of consciousness, and suggest new means to probe them, in a more ecological manner.

Elisabeth Pacherie

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Intentional action and automaticity

Intentional or voluntary actions are often contrasted with automatic actions. In this talk, I explore the nature of this contrast. On the one hand, it is disputed how automaticity should be characterized. A number of theoretical views suggest that automaticity should be diagnosed by looking at the presence of features such as uncontrolled/uncontrollable, goal independent, autonomous, purely stimulus driven, unconscious, efficient, and fast. However, it is debated how these features relate, whether they form a set of necessary and sufficient conditions for automaticity, and whether automaticity is all or none or can be graded. On the other hand, an investigation of the cognitive architecture underpinning voluntary action shows it to be supported by a hierarchy of representations and processes, some of which exhibit some or all of the features associated with automaticity. This suggests that the contrast between intentional and automatic isn't a straightforward matter. I will try to disentangle the forms of automaticity that are consistent with intentional action (or indeed necessary for it), contrasting them which forms of automaticity that are a threat to intentional action.

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Can we separate (the functional anatomy of) volition from sense agency?

According to different theories, the perception of will and the sense of agency for willed acts (1) rely on a post-hoc reconstruction, by "drawing causal inferences about relationships between thoughts and actions"[1] and eventual physical consequences in the outside world or (2) is part of the predictive operations, and comparisons with outcomes, generated by the mind-brain when eventually putting into action some intentions[2,3].

The two hypotheses may imply, loosely, some distinct functional anatomical predictions. In particular, the theory of apparent mental causation[1] implies that the experience of agency and motor intentionality could be appreciated through a general-domain cognitive appraisal module, which processes and integrates separate environmental and contextual cues with thinking, to infer causality. As a consequence, the generation of the sense of agency would not depend on the system that implements the intentional actions as motor plans.

The "predict and compare" motor theory[2,3] may allow one to anticipate that the sense of agency emerges from the operations of some (pre)motoric brain regions functionally connected with, yet maybe separable from, the brain circuitry that specifically contributes to the making of intentions.

Anatomical considerations on the nature of the areas involved may ease the interpretations of functional anatomical findings and their explanatory power in favor of one of the aforementioned theories.

For example, a systematic involvement with the sense of agency of premotor regions connected with the spinal cord, may pull the argument in favor of a "predict and compare" motor interpretation of agency whereby the motor signals explicitly contribute to the construction of such mental state[3,7], as motor plans unfold. Given that prefrontal cortex is not connected directly with spinal cord neurons, the finding that prefrontal "intention specific" brain areas are the same implicated in the sense of agency would rather militate in favor of a cognitive reappraisal theory.

In this talk, I will review four imaging studies (two published, one submitted and one in-preparation) on intentional action[4,5] and sense of agency[7,8] for willed actions. I will discuss how these support one or the other theory. In the two published studies on intentionality -one a meta-analysis, another an empirical study- we defined the functional anatomy of intentionality and tried to disentangle subcomponents along the what, whether and when dimensions[4-6]. In the two more recent studies we performed a meta-analysis of experiments on the sense of explicit agency for willed acts, and we compared them with the motor intention literature[7]; the last in-preparation study is about functional anatomy of the intentional binding phenomenon, an implicit measure of the sense of agency[3,8].

The main results of this work can be summarized as follows: (1) it was possible to separate brain systems involved in generating intentional (non-conditional) actions and (2) brain regions more concerned with the emergence of a sense of agency for willed acts. The latter group of regions belong to the sensory-motor network. However, (3) along with the distributed rostrocaudal gradient of brain areas for intentionality and agency respectively, there are intermediate regions shared by the two levels of representation[7], a potential common ground that may serve for the integration of truly motoric representations with more conceptual levels of intentionality to generate the sense of agency for willed acts.

This approach of searching for separations and convergences between different processes has its limitations, though: for example, as shown by the meta-analysis on intentionality[5], the brain areas involved in intentional actions are commonly seen also for motor paradigms in which subjects act following conditional rules rather than their intentions. This evidence, suggests that "volitional and agency networks" may contribute to these cognitive processes through a change of state within distributed sensory-motor and cognitive networks. The details of these changes of state will be hardly captured by the common haunt for segregations or overlaps afforded by the univariate statistics used

with imaging data discussed here. Possible strategies for capturing these elusive physiological phenomena with experiments on intentionality and sense of agency will be discussed.

References can be found here: https://goo.gl/CshwHA

Roland Pfister

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Volition in action: Towards an agent-centred perspective on rule-violation behaviour

Rule violations are a ubiquitous in human society, and they are studied from a variety of interdisciplinary perspectives. Moreover, they are a prime instance of volitional behaviour because deliberate rule violations necessarily entail a volitional resolution to break with current rules and norms. Most prior research on deliberate rule violations has adopted a third-person perspective, asking whether or not a given agent, in a given situation is likely to violate a rule. By contrast, little is known about the processes that occur in the rule-breaking agent right at the moment that he or she violates a rule. To approach such an agent-centred, first-person perspective on deliberate rule violations, I will present a series of behavioural experiments that show how committing a rule violation bears cognitive conflict for the rule breaker: Performance measures and kinematic analyses reveal that the rule representation cannot be suppressed easily so that the rule-breaker is continuously torn between what they ought to do and following their intended course of action. These findings open up a new theoretical approach to violation behaviour, shifting the focus from precursors and consequences of this ubiquitous behaviour to the actual cognitive, motivational, and affective processes that occur right at the moment a rule violation takes place.

Nura Sidarus

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Against your will: how learning is influenced by conflict between instructions and subjective beliefs

Goal-directed action requires learning which actions will yield desirable outcomes. Besides learning from our freely chosen actions, we may also benefit from learning from instructed actions. But what if we have to follow instructions that we disagree with? Our work investigated how learning is influenced by having a choice in what to do, and by conflict between instructions and subjective beliefs about action values. Participants completed a reversal-learning task. Using computational models of reinforcement learning, we estimated the accumulated, subjective action values, and assessed differences in learning rates across conditions. Results showed that learning rates were reduced for instructed than for freely chosen actions. Learning rates were further reduced by conflict between instructions and subjective action values. These findings suggest that being forced to go against our will carries a cost to learning. This has implications for how our experience of agency shapes our interactions with the external world.