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Review

From commonsense to science, and back: The use of cognitive concepts in neuroscience

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ABSTRACT

Commonsense cognitive concepts (CCCs) are the concepts used in daily life to explain, predict and interpret behaviour. CCCs are also used to convey neuroscientific results, not only to wider audiences but also to the scientific inner circle. We show that translations from CCCs to brain activity, and from brain data to CCCs are made in implicit, loose and unsystematic ways. This results in hard to connect data as well as possibly unwarranted extrapolations. We argue that the cause of these problems is a covert adherence to a position known in philosophy of mind as 'mental realism'. The most fruitful way forward to a clearer and more systematic employment of CCCs in cognitive neuroscience, we argue, is to explicitly adopt interpretivism as an alternative for mental realism. An interpretative stance will help to avoid conceptual confusion in cognitive science and implies caution when it comes to big conclusions about CCCs.

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1. Introduction

Despite seven decades of hard work on rabbits, rats, mice, gerbils, guinea pigs, sheep, cats, dogs, Old World monkeys, chimpanzees, and humans by outstanding colleagues, to date, there is still no agreed term that would unequivocally describe behavioural correlate(s) of hippocampal theta rhythms. [. . .] [A] sober conclusion is that our behavioural-cognitive terms are simply working hypothetical constructs that do not necessarily correspond to any particular brain mechanism (Buzsáki, 2006).

Cognitive neuroscience deals with data such as BOLD signals,[1] electrophysiological data and reaction times. Such data may be of direct interest to neuroscientists, but their relevance stems mainly from the fact that they tell us something about the human *mind*. This is specifically true from the perspective of the lay public, which is generally enthusiastic about cognitive neuroscience, but which only wants to hear about specific neural activity because this is considered to tell them something about cognitive functions they are familiar with, such as thinking, loving and choosing. Hence, cognitive concepts are used to convey neuroscientific results, not only to wider audiences but also to the scientific inner circle. Scientific publications on the possible neural correlates of e.g. consciousness, romantic love, hate, personality, decision making, error awareness, etc. are common. Expressing what makes cognitive neuroscience exciting – the fact that it tells us something about *us*; about who we are and what makes us tick – requires the use of commonsense cognitive concepts.

This fact makes it imperative that we have a clear and systematic view on how we get from commonsense cognitive concepts to scientific experiments and from hard scientific data to commonsense concepts. In this paper we will argue that so far these issues are at best addressed in an implicit manner in cognitive neuroscience. Transitions from commonsense psychology to hard science and back are often made without explicit ideas on how mind and brain relate. We argue that this results in incompatible operationalisations of 'the same' cognitive concept and consequently hard to connect data and possibly unwarranted extrapolations.

To give an initial sense of one kind of problem we have in mind, here is an example of a single cognitive concept that is used by different researchers to refer to different cognitive processes, measured by different tasks. The concept of 'working memory' (Poldrack et al., 2011) is interpreted by Goldman-Rakic as 'holding information online' when working with non-human primates using tasks such as the oculomotor delayed response task (Goldman-Rakic, 1995). Baddeley uses the concept as 'manipulating information held in memory' by humans, using e.g. the letter–number sequencing task (Baddeley, 1992). Olton et al. use the concept as a rough equivalent of episodic memory, that is as memory for temporally varying aspects of a task, when measuring rodents using a radial arm maze task with varied food locations (Olton, Becker, & Handelmann, 2011). As a result of this ambiguous use of the concept 'working memory', it is difficult to combine insights from different studies into convergent knowledge about the neuroscientific basis of working memory.

Disentanglement of these kinds of difficulties starts with adopting an explicit view on how commonsense cognitive concepts relate to operationalisations and tasks and to the neuronal processes that allow us to execute these tasks. We need a theory of the mind–brain relation that fits the actual practices of cognitive neuroscience. In this paper we will argue that most classical positions in the philosophy of mind are not up to that job and tentatively propose what we consider to be the most useful view on the relation between mind and brain.

This paper is organized as follows. In Section 2, we show how cognitive commonsense concepts are used in cognitive neuroscience and why this use is problematic. Section 3 describes the development of 'cognitive ontologies' as a means of dealing with these issues. The success of this strategy depends on a clear view on the root of the problem. In Section 4 we identify this as a covert adherence to mental realism. Based on the discussion in the previous three sections, we argue that the most fruitful way forward to a clearer and more systematic employment of commonsense cognitive concepts in cognitive neuroscience depends on the acceptance of an interpretivist view on the relation between mind and brain.

2. Commonsense cognitive concepts in cognitive neuroscience: problematic translations at multiple levels

Commonsense cognitive concepts (CCCs), also referred to as 'folk-psychological concepts', are the concepts we use in daily life to explain, predict and interpret behaviour. 'Thought', 'intention', 'fear', 'joy', 'disgust', 'consciousness', 'attention', 'desire', 'belief', 'wish', etc. are cases in point. How are these CCCs used in cognitive neuroscience? And how are neuroscientific data – such as BOLD signals, electrophysiology data, reaction times – translated in CCC-terminology? How are questions about the human mind, which are very often cast in CCC terms, operationalised in experiments? In this section we will argue that such transitions are often made in a loose, unsystematic and implicit manner.

Here it may be objected beforehand that much cognitive neuroscience is not concerned with rough and vague commonsense concepts but rather with scientifically 'cleaned-up' versions of these. We agree. We shall refer to such concepts as SCCs, scientific cognitive concepts. Scientific cognitive concepts are formal, scientific versions of common sense cognitive concepts. Often, the particular concepts have the same name (e.g. 'memory') but the SCCs usually differ from CCCs e.g. in their sectioning in sub-concepts (see Fig. 1). Thus, the SCC 'memory' differs from the CCC 'memory' in that the former is composed of more specifically delineated SCCs such as 'working memory' and 'long-term memory', to name a few. The scientific status of the SCC 'memory' results from the precision of these sub-concepts. Ideally, SCCs are formalized versions of CCCs with clearer definitions that are shared by the entire scientific community. We shall argue that though SCCs are certainly more

[1] The fMRI (functional magnetic resonance imaging) signal is usually referred to as the blood oxygen level-dependent (BOLD) signal since fMRI relies on changes in the level of oxygen in the human brain induced by alterations in blood flow.