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The realizers and vehicles of mental representation

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ABSTRACT

The neural vehicles of mental representation play an explanatory role in cognitive psychology that their realizers do not. Cognitive psychology individuates neural structures as representational vehicles in terms of the specific causal properties to which cognitive mechanisms are sensitive. Explanations that appeal to properties of vehicles can capture generalisations which are not available at the level of their neural realizers. In this paper, I argue that the individuation of realizers as vehicles restricts the sorts of explanations in which they can participate. I illustrate this with reference to Rupert's (2011) claim that representational vehicles can play an explanatory role in psychology in virtue of their quantity or proportion. I propose that such quantity-based explanatory claims can apply only to realizers and not to vehicles, in virtue of the particular causal role that vehicles play in psychological explanations.

1. Mental representations: realizers and vehicles

In cognitive psychology, mental representations are understood as concrete particulars with both semantic and non-semantic properties. In virtue of their semantic properties, representations can be interpreted as bearers of content, and thus account for the intentionality of mental states. In virtue of their non-semantic properties, representations can play a causal role within a mechanistic system, which is usually assumed to be computational. The *realizers* of representations are whatever physical structures satisfy the appropriate roles; in human beings, these physical structures are likely to be neural configurations.[1] This framework of roles and realizers is familiar from functionalist approaches to philosophy of mind.

Traditionally, representational mental states are individuated by their intentional contents: a thought that refers to cats and a thought that refers to dogs are distinct thoughts in virtue of having different referential contents. But it is a well-known fact that two mental states with the same referential content don't always play the same explanatory role in intentional explanation. Lois Lane's SUPERMAN concept does not play the same role as her CLARK KENT concept in explaining her behaviour, for example, despite the fact that the concepts co-refer. And as Twin-Earth cases demonstrate, two mental states can sometimes play the same explanatory role despite having distinct references: it is arguable that Oscar's WATER concept plays the same explanatory role in his behaviour as Twin-Oscar's WATER concept plays in his behaviour, despite the fact that Oscar's concept refers to H_2O while Twin-Oscar's concept refers to XYZ. Any approach to psychological explanation needs to account for the *cognitive significance* of a representation's referential content: the way in which the referent is represented. In philosophy, this role is often associated with Fregean sense. Fregean senses, however, are not the sorts of naturalistic entities that cognitive psychology can endorse.

Naturalistic approaches to mind attempt to account for semantic properties (e.g., meaning, reference) in terms of non-semantic (e.g., causal, functional, or teleological) relations between representations and the aspects of the world they represent. Naturalistic theories of content acquisition can give an account of the referential content of representations, but naturalistic psychological explanation still needs to explain why co-referential representations can play distinct causal roles with the cognitive system. This requires that we have a way to individuate representations non-semantically, to give a finer-grained classification of representations than by their referential contents, but in a way which doesn't appeal to non-naturalistic semantic notions like Fregean sense. This is where representational *vehicles* come in.

In cognitive psychology, representational vehicles are the bearers of content. In addition to their semantic properties, they also have non-semantic properties to which the cognitive

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[1] The physical structure may itself be functionally characterized, and realized by a physical structure at a lower level of abstraction. For further details of the role/realizer relation and its application to representational theories of mind, see Bermudez (2005).

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mechanisms are sensitive. The nature of these mechanisms will determine which non-semantic properties are the relevant ones: they might be formal properties, functional properties, or physical properties.[2] As Shea (2007) emphasises, the non-semantic properties which individuate representational vehicles are those which are recognisable to the cognitive mechanisms in question:

> The entities that vindicate the cognitive revolution's first and defining commitment – to an internal mechanism involving vehicles of content which are individuable non-semantically – deserve to be called representations. Typing representations as vehicles of content groups together different internal entities into classes that are importantly alike for internal processing […]: they are different realisations of the same vehicle of content. (Shea, 2007, 247–248)

Individuating representations by the relevant non-semantic properties enables us to say whether two neural structures realize the same representational vehicles or distinct representational vehicles. This notion of representational vehicles allows us to explain why the same referential content can play distinct explanatory roles, but without appealing to semantic concepts like Fregean sense. Instead, cognitive psychology appeals to the fact that the same referential content can be carried by distinct vehicles of representation, where those vehicles play distinct causal roles within the mechanism. Conversely, the fact that distinct referential contents can be carried by the same vehicle of representation, where the bearers of the two contents play the same causal role within the mechanism, explains how those contents can play the same explanatory role. Examples of representational vehicles include symbols in classically computational architectures, clusters in state space in connectionist networks, and attractor basins in dynamical systems.[3]

Notice that representational vehicles play a causal explanatory role in cognitive psychology that their realizers do not. Cognitive psychology appeals to generalizations over neural structures in terms of the way they participate in cognitive processes: the features in virtue of which those neural structures play the same or distinct causal roles within the mechanisms responsible for our cognitive capacities. Focusing on the vehicles of representation allows us to capture these generalizations in a way that we can't capture if we focus solely on their lower-level neural properties. The distinction between neurological and psychological explanations can be grounded by the distinct explanatory roles of the realizers of representations and the vehicles of representations.[4]

In work by Robert Rupert (2011), this distinction between vehicles and realizers of representation plays an important role.[5] Rupert proposes a view of the mind as "massively representational": he thinks not only that the brain supports more mental representations than has previously been acknowledged, but also that the quantity or proportion of mental representations plays an explanatory role in the sciences of the mind. Rupert explicitly claims that he is thinking of these mental representations as distinct vehicles, rather than merely as distinct realizers. I'll outline Rupert's claim in the next section of this paper, before going on to explore his justification for these claims. I will argue that Rupert's commitment to the explanatory role of distinct vehicles leaves him unable to establish that the mind is massively representational in the sense he suggests. Furthermore, I will suggest that the only way for Rupert to establish that quantity is playing a key explanatory role is for him to accept that the states in question are merely distinct realizers.

2. Rupert and the 'massively representational' mind

Rupert proposes that the mind is "massively representational". First, he proposes that there are far more representations than previously acknowledged: that "[t]he mind-brain contains an enormous number of basic mental representations" (102). Second, he argues that the quantity or proportion of representations can play a role in psychological explanation: that "variation in the sheer number of vehicles […] plays a causal-explanatory role in the production of certain forms of behaviour" (111).

Rupert makes clear that his proposal concerns the number of representational *vehicles*, rather than merely the number of *realizers*. Rupert explicitly rejects the "more modest claim that, for any given mental representation, the subject is likely to have many realizers of it or merely has many psychologically equivalent vehicles" (111); and he rejects any interpretation of his view on which the cognitive states that he is treating as distinct vehicles of representation "are, instead, various realizers of the same mental representation" (110).

Furthermore, Rupert assumes that in making a claim about vehicles rather than realizers of representation, he is offering a psychological explanation rather than a neurological explanation:

> Partly because the number of active vehicles does explanatory work in cognitive science, I take being a particular vehicle to be a psychological-level construct—unlike mere realizers, which appear only at some lower level than, or as part of an explanatory enterprise distinct from, psychology. (111)

Rupert's key claim, that the number of representational vehicles involved in a cognitive process is a causal-explanatory factor in psychology, can thus be understood as the conjunction of two claims: one claim about the *quantity* of cognitive states involved and a second claim about the *vehicular* status of these cognitive states:

> **Quantity**: Some psychological phenomena are explained by the number or proportion of cognitive states contributing to their production.
>
> **Vehicle**: The cognitive states that explain the psychological phenomena in question are distinct vehicles of representation; they are not merely distinct realizers of the same vehicle.

I will argue that Rupert cannot hold both the Quantity and Vehicle claims, and thus cannot establish his claim that the mind is massively representational. In order to establish that the cognitive states are distinct *vehicles* of representation, the states in question need to be individuated by the non-semantic properties to which the cognitive mechanisms are sensitive, in virtue of which distinct vehicles play distinct causal roles. But in order to establish that the *quantity* of a certain kind of cognitive state is explanatorily important, the states in question must share a property in virtue of which they qualify as the same kind of cognitive state. But any such shared property seems to 'screen off' their distinct causal roles, meaning that their role in explanation is not *qua* distinct vehicles. The very concept of a representational vehicle precludes vehicles

[2] For discussion of these approaches to vehicle individuation, see Stich (1983) and Aydede (2000).

[3] See Shea (2007) for discussion of vehicles in different mechanisms, with a focus on connectionist networks.

[4] The distinction between neurology and psychology is not actually this clear cut. But this rough approximation is assumed by Rupert (2011), and will be acceptable for my purposes in this paper.

[5] All further references to Rupert's work are to the 2011 paper unless other specified.

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