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**Sculpting the space of actions: explaining human action by integrating intentions and mechanisms**

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## 6 CONCLUDING REMARKS AFTER CONSIDERING THE FOUR METHODOLOGIES

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With the explanation of dynamic changes of a cognitive function, we have probably touched upon the most difficult topic both for empirical explanation and for its philosophical analysis. This difficulty already transpired when we acknowledged that it raises questions of identity and difference that belong traditionally to the metaphysical realm. To the extent that these questions touch upon the observation, interpretation and explanation of behavior we can even recognize normative issues at stake: are bird song or infant crying forms of singing, can automatized behavior be a form of moral action?

These remarks implicitly account for both our acceptance and rejection of parts of the argument discussed in chapter I.2, where we considered the role of conceptual analysis in cognitive neuroscience. Even though we did gladly acknowledge the importance of definition as a heuristic and as a form of constraint on scientific research, the neglect by Bennett & Hacker of the pluralism in classifications and definitions, and of the problem of blurred distinctions rendered their view of conceptual analysis inapplicable. Moreover, as a consequence of their assumption that singular definitions on the basis of conceptual analysis and behavioral criteria are possible, the authors strictly demarcated conceptual from empirical work, as was demonstrated by their quote: “[c]onceptual truths delineate the logical space within which facts are located. They determine what makes sense. Consequently facts can neither confirm nor conflict with them” (Bennett and Hacker 2007 129). However, once the assumption of a strictly delineated logical space on the basis of conceptual truths is abandoned, the relation between conceptual analysis and empirical science must be redesigned.

Unsurprising to most of us, cognitive neuroscience is a highly interdisciplinary field where the integration of insights is required. The role for conceptual analysis or definition still needs to be determined, as does the form of its integration with empirical insights. Both were found to be relatively loose in the approach that aims at neural correlates of consciousness. Probably because the concept or definition of consciousness is notoriously problematic in itself, the search for its neural correlates was found to be performed without a preliminary definition of consciousness. In fact, the NCC approach partly aims to circumvent that problem by seeking to employ empirical evidence alongside concept analysis as a way to delineate the phenomenon of consciousness more precisely. As a case in point we referred to the existing analogy between the proposed neural correlate of recurrent processing (Lamme 2006 499)

and the definition of consciousness as reliving or rekindling experience (Dennett 2005).

The other two approaches were more articulate about the requirements for a preliminary definition of the function or phenomenon to be investigated, and the role of such a definition. In the case of Marr's methodology, it was a more precise task analysis that should help to delineate further investigations. The role of further empirical evidence for this computational theory was somewhat ambiguous in his approach, we found. Even though Marr suggested to keep the three levels or theories relatively independent, he himself actually considered mutual constraints between these three levels, if only as constraints on the search space for options of the neighboring level.<sup>141</sup> A particular algorithm theory, for example, would be best served by a particular neural implementation, which subsequent empirical research could try to determine, or vice versa (Marr 1982). This modest integration of insights stemming from different levels or perspectives of research was found to be even more elaborate in the mechanistic explanation approach.

Employing several of the heuristics or methods that were discovered in the other three approaches, mechanistic explanation appeared to be both relatively modest in its ambition – as an explanatory mechanism is primarily relevant to a particular phenomenon – and explicit in its performance and requirements. For example, it requires researchers to delineate or define the phenomenon of their research, while leaving them room for its later redefinition or reconstitution. As we argued, such redefinition or reconstitution can be the useful result of the detection of particular properties or constraints of the phenomenon's explanatory mechanism. Consequently, research leads to a continuous integration of results in the development of an increasingly elaborate mechanistic explanation. More than the other approaches, mechanistic explanation is suitable for such an integration, since it can handle not just simple but also complex phenomena and include dynamical aspects like development and learning.

To a large extent, therefore, mechanistic explanation collects resources and tools to handle and integrate elements that were present in the previously discussed explanatory approaches. Moreover, with its particular interest in the organized dynamics of a mechanism that produces a complex phenomenon, this approach can facilitate the investigation of the subject of this dissertation. Focusing as it does on the complex dynamics of action determination, to which different components

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<sup>141</sup> In fact, as we noted earlier, Marr used all three levels to constrain each other. Kosslyn accordingly arranged the levels in a triangular fashion, ascribing equal weight to all three (Kosslyn and Maljkovic 1990).

contribute, both in terms of parts and of operations, the resources of mechanistic explanation help in formulating questions and organizing results. As philosophical – conceptual – analysis will teach us that the determination of action involves both explicit decision making processes as well as tacit automatisms and habits, we can expect a variety of components involved in constraining or sculpting the space of actions depending upon the relevant mechanism. Moreover, the explanatory mechanism also allows us to elucidate the transformative impact of learning, of automatization and habit formation on this space of action by referring to its components and their organization and interactions.

Given the importance of the modification of an explanatory mechanism under the influence of development and learning, the next part will be devoted to that topic. We will observe different explanations for the modification of a mechanism responsible for a particular function. Such a modification can occur, so we will learn, under the influence of information or concepts that somehow become integrated in the responsible mechanism; information that may be represented in the environment, but also employed by an agent himself as a form of self-regulation. Part II is meant to support the hypothesis that not just simple but also complex functions are suitable for automatization and habituation, which will eventually affect their properties – like the automatization of singing in experts having an impact on its speed, efficiency, control, flexibility, and so on. Discussion of this phenomenon, so prevalent in dynamic systems, will also bring back the questions that we raised at the beginning: must we adjust the definition of a function once we discover that it can be performed under such different conditions and with correspondingly different properties? Does it make sense to talk about ‘dual-processes’ that allegedly underpin many forms of human cognition and action and to consider these as two distinct mechanisms? Must we then also consider redefinition or reclassification of the phenomena these mechanisms produce? Or should we consider these processes as being produced by a single explanatory mechanism under different conditions and with different outcomes?<sup>142</sup> Again, these questions are not just empirical, but also philosophical and even normative – questions that will not leave us in the rest of this dissertation.

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<sup>142</sup> Though this is not the place to discuss this, the relevance of neural dissociation research is also at stake here. Is the finding that two distinct processes or mechanisms are involved in different performances of a particular function enough reason to split the function into two distinct functions? Or are such empirical results completely irrelevant to our conception of that function? To the extent that dissociation research relies upon specific assumptions of modularity, its logic is rejected by (Orden, Pennington et al. 2001). However, it is argued that double dissociation research depends upon less strict assumptions and that its evidence can be used as additional support for a particular cognitive theory over others (Davies 2010).