



## NEW IDEAS

### The Mechanistic Approach to Psychiatric Classification

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*A Kuhnian reformulation of the recent debate in psychiatric nosography suggested that the current psychiatric classification system (the DSM) is in crisis and that a sort of paradigm shift is awaited (Aragona, 2009). Among possible revolutionary alternatives, the proposed five-axes etiopathogenetic taxonomy (Charney et al., 2002) emphasizes the primacy of the genotype over the phenomenological level as the relevant basis for psychiatric nosography. Such a position is along the lines of the micro-reductionist perspective of E. Kandel (1998, 1999), which sees mental disorders reducible to explanations at a fundamental epistemic level of genes and neurotransmitters. This form of micro-reductionism has been criticized as a form of genetic-molecular fundamentalism (e.g. Murphy, 2006) and a multi-level approach, in the form of the burgeoning Cognitive Neuropsychiatry, was proposed. This article focuses on multi-level mechanistic explanations, coming from Cognitive Science, as a possible alternative etiopathogenetic basis for psychiatric classification. The idea of a mechanistic approach to psychiatric taxonomy is here defended on the basis of a better conception of levels and causality. Nevertheless some critical remarks of Mechanism as a psychiatric general view are also offered.*

**Keywords:** Cognitive Neuropsychiatry, Cognitive Science, psychiatric classification, mechanism, mental dysfunction, multi-level, taxonomy.

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#### INTRODUCTION

The awareness of limits of the current psychiatric classification system (the DSM) is an unquestionable fact in the present debate (Kupfer et al., 2002). Less obvious is putting such a taxonomy into a general crisis, which could decree a concrete and complete reformulation. DSM-V, expected for 2013, will hardly be presented as such.

A Kuhnian reformulation of the recent debate in psychiatric nosography suggested that Psychiatry is *pre-paradigmatic* concerning etiopathogenesis. Its alternative theoretical approaches (Biological Psychiatry, Psychoanalysis, Phenomenology, Behaviourism and Cognitivism) do not disappear when one gets dominant, but they come into favour again in a short time (Aragona, 2006). On the contrary, it was argued that for psychiatric nosology the DSM-III represented the beginning of a *paradigmatic* phase which is now in crisis, a sort of paradigm shift being awaited (Aragona, 2009). While most of the DSM limits are imputable to its lack of an

etiopathogenetic substrate (Sirgiovanni, 2008, Sirgiovanni, 2009), psychiatrists are unlikely to find a total agreement on the etiopathogenetic view to be shared. And this means that all bad consequences of the DSM approach in diagnosis and research will hardly be put aside soon.

However, some possible alternatives are rising. A practical suggestion by Charney et al. (2002) was to reconceive five-axes system in prominent terms of genes. Even if not appearing revolutionary at first sight, this proposal hides the seed of question of etiopathogenesis. Such a proposal, in fact, looks like much more along the lines of the micro-reductionist perspective coming from Molecular Biological Psychiatry (Kandel, 1998, 1999) than along those of rival approaches. Nevertheless, this micro-reductionist approach, which sees mental illness explanations findable at the smallest level of genes and neurotransmitters, was criticized by another approach, still within medical model (Guze, 1992), which proposes a *multilevel* Psychiatry conceived as

a “Clinical Cognitive Neuroscience” (Murphy, 2006). This suggestion calls for a new direction of research, namely a Cognitive Neuropsychiatry (Halligan and Marshall, 1996; see Broome and Bortolotti, 2009 for critical analyses), according to which mental disorders are conceived as dysfunctions of neurocomputational mechanisms.

In this article I will focus on the effects of such conceptions on the form of psychiatric explanation and classification. In particular, I will explore the idea of extending the mechanistic approach in Cognitive Science to Psychiatry and I will argue that this approach calls for a better revision of the concept of causality and of the epistemic levels involved. Finally, some problematic features of this perspective as basis for the future philosophical research will be also considered.

### **MECHANISM: FROM COGNITIVE NEUROSCIENCE TO COGNITIVE NEUROPSYCHIATRY**

The idea that explaining a phenomenon involves understanding the mechanism responsible for it<sup>1</sup> has deep roots in the History of Philosophy from atomic theories in 5<sup>th</sup> century b. C. to its rebirth in the 17<sup>th</sup> and 18<sup>th</sup> century in the works of Galileo, Descartes, and Boyle. Among others, it's Descartes' idea that machines humans build could work as models of scientific explanation.

In Cognitive Science, Mechanism (Bechtel, 2008, Craver, 2007) is a compromise between two dominant and broad traditions on mind-brain: the *reductive* tradition holding a downwards direction of inquiry into brain, even though not in the classic views of reduction (Ernst Nagel, including *new wave* reductionist as J. Bickle, P. Churchland or K. Schaffner), and the *system* tradition which construes explanation as a matter of decomposing systems into their parts and showing how those parts are organized together in such a way to exhibit the *explanandum phenomenon*.

Mechanistic approach to Cognitive Science, also known as a *localization and decomposition heuristic strategy* (see Bechtel and Richardson, 1993, McCauley and Bechtel, 2001), has a number of features which depend on the following

characterization of the term “mechanism”:

“a structure performing a function in virtue of its component parts, component operations, and their organization. The orchestrated functioning of the mechanism is responsible for one or more phenomena” (Bechtel and Abrahamson, 2005, p. 3).

First, mechanism is identified in terms of the phenomenon for which it is responsible in order to *reconstitute* the phenomenon itself thanks to the understanding of the internal operation of the mechanism. Second, a mechanism consists of *parts and operations*. Namely, structural components and processes and changes involving them (in Chemistry, for example, we will speak of reactions while in cognitive domain the reference is to *information processing*). Third, parts and operations must be organized appropriately.

The identification of parts and operations involves what is called a *mechanistic decomposition* that involves decomposing the mechanism *structurally* (looking for parts) and *functionally* (looking for operations). Moreover, the process of linking parts and operations is a *localization*, since to localize an operation is to assign it to a specific part. However parts of the mechanisms are not just any physically separable parts – rather, they are *working* parts, parts involved in operation. Yet parts and operations are intimately connected. As a matter of fact, *organization* plays a critical role in the mechanistic approach, according to which the functioning of the mechanism requires the different operations to be linked one another. This is observed beginning from simple *linear* organization to far more *complex* modes of organization such as cyclic pathways and feedback loops exhibited in living systems. A central feature of the mechanistic explanation is that the operation of the parts enables the mechanism as a whole to behave in a specific way<sup>2</sup>. Of course the mechanism as a whole also engages entities in its environment, and environmental conditions play important roles in the mechanistic analyses.

Mechanistic approach involves techniques which goes from Cognitive Psychology tests to neuroscientific data and usually makes use of forefront devices as fMRI. This is why it is conceived by its theorists as a *pluralistic* epistemological approach (McCauley and Bechtel, 2001). Examples of mechanistic research and explana-

tion in Cognitive Science are those of systems of vision and memory (see Bechtel, 2008).

Recently, a remarkable suggestion was that of reconciling different research traditions as the study of Psychopathology and the research of Cognitive Neuroscience (Murphy, 2006) in the form of the rising and above-mentioned Cognitive Neuropsychiatry, providing models and tools for the reformulation of psychiatric taxonomy on psychiatric *symptoms* (and not on DSM *syndromes*). First, the *deficit* paradigm for Psychopathology, alternative to the *conflict* paradigm from Psychoanalysis, is advanced, as well as the assumption of *subtractivity* from the normal cognitive functioning. So clinical psychopathologies would be intended in terms of deficits to normal cognitive mechanisms. Second, the reductionist view is suggested by the “neuro” prefix, which links Psychiatry to neural substrates granted by the new techniques of functional neuroimaging. In the next paragraph I will extend the idea of a Cognitive Neuropsychiatry guided by a mechanistic approach and I will try to show the benefits of this approach compared to the micro-reductionist one in terms of a better conception of epistemic levels and causes.

### **MECHANISTIC EXPLANATIONS FOR PSYCHIATRIC DISORDERS: LEVELS AND CAUSES**

The proposal of a cognitive neuropsychiatric taxonomy tries to reconcile the personal level of Folk Psychology, the computational level of Cognitive Psychology, and the neuronal level. Although it is a reductionist inquiry, trying to explain cognitive phenomena by means of underlying brain mechanisms, it is not necessarily a micro-reductionist one. By embracing a mechanistic approach to cognitive neuroscience (Bechtel, 2008, Craver, 2007), influenced by complex systems theory, neurocomputational mechanisms can be conceived as the interrelated functioning of an organized whole of elements. Explanations in Cognitive Neuroscience typically span multiple levels in the sense of “levels of mechanisms” (see Craver, 2007). In this view, systemic properties can be explained at different neuronal levels, not necessarily the smallest. An example comes from the explanation of

spatial memory (LM) that is commonly said to have four exemplifying levels: 1. the level of the spatial memory phenomenon; 2. the level of the computational properties of neural systems, including brain regions such as the hippocampus and other areas in the temporal and frontal cortex; 3. the cellular-electrophysiological level or the *Long Term Potentiation* in hippocampal synapses; 4. the molecular mechanisms that make the chemical and electrical activities of nerve cells possible (Craver, 2007).

LM levels are *levels of mechanisms* (see Fig. 1) as the *relata* are behaving mechanisms at higher levels and their components at lower levels. Furthermore, these *relata* are properly conceived as acting entities. Explanations in Cognitive Neuroscience are multilevel because of *organization*, which is the core interlevel relation between the mechanism as a whole and its components and makes the mechanisms something more than the mere sum of the parts.

Applied to Psychiatry, mental disorders might be breakdowns of neurocomputational mechanisms in these terms. This contrasts with philosophical micro-reductionism (Oppenheim and Putnam, 1958), according to which fundamental explanations are those which recur at the lowest level of nature as the only relevant level of causal relation. A paradigmatic example in Cognitive Neuropsychiatry is the hypothesis of Capgras delusion (Ellis and Lewis, 2001), explained as the interruption in the covert route to face recognition, namely affective responses to familiar stimuli, localized in the dorsal route of vision from striate cortex to limbic system. According to standard molecular hypotheses, acute delusions are the result of a dysregulated activity of some neuromodulators. However, the crucial question is how the activity of neurotransmitters can be linked to cognitive processes. As a matter of fact, Molecular Psychiatry has often attempted to move directly from clinical label to biochemical deficit without paying attention to the systemic level of analysis that could mediate between behavior and material substrate.

According to its proponents, the neuropsychiatric hypothesis of Capgras delusion might be the first step towards a mechanistic explanation, spanning multiple levels from the phenomenon

to brain areas through computational characterizations coming from Cognitive Psychology (see Sirgiovanni, 2007 for discussion). In other words, psychiatric multilevel explanations allow to localize mechanism breakdowns at various levels depending on their epistemological relevance. Furthermore, often the explanation for why a phenomenon (here a psychiatric condition) was instantiated on a given occasion involves establishing that the relevant environmental conditions were satisfied. In mechanistic analyses, both the levels of the parts and the levels of mechanism engaging its environment are critically important. Thus mechanist approach aims to bridge a gap between medical and biopsychosocial model (see Murphy, 2006).

**CONCLUSIVE REMARKS**

The mechanistic approach to Psychiatry is a remarkable effort to reconcile multiple descriptive strategies, without committing to a fundamental explanatory level for all disorders. At present such an approach cannot provide a systematic reformulation of psychiatric taxonomy, but it could suggest interesting directions for future psychiatric research. Nevertheless, some features of the model have to be considered. Above all, a proper mechanistic account of reasoning impairments, which the debated showed to be involved somehow also in Capgras delusion, is far to be achieved (see Davies and Davies, 2009). Therefore, currently, such an explanation is at best incomplete. More generally, even though declaring itself to be multilevel, the mechanistic approach takes into consideration the personal level just for the description of explananda. Folk Psychology is, in fact, not intended as a proper level of explanation and many philosophers foresee a theoretical danger because of it. Admittedly, I am not

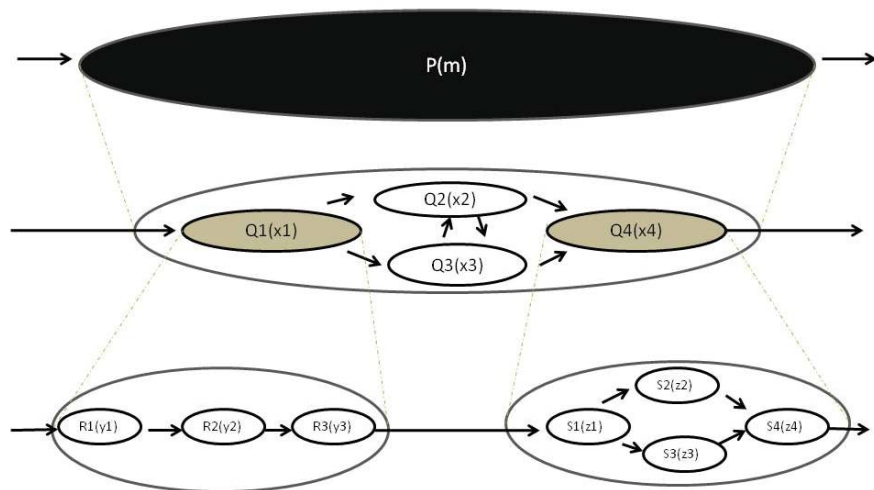


Fig. 1. Levels of mechanism. Three mechanistic levels are defined locally within decomposition hierarchies. At the top is a phenomenon P (property or behavior) engaged by a mechanism m. P(m) is explained by the organization of entities or parts {x1, x2, ..., xn} and activities or operations {Q1, Q2, ..., Qn}. Q1 x1 is explained by the organization of entities or parts {y1, y2, ..., yn} and activities or operations {R1, R2, ..., Rn}. Q4 x4 is explained by the organization of entities or parts {z1, z2, ..., zn} and activities or operations {S1, S2, ..., Sn}, and so on. Freely inspired from Craver (2007, p. 194).

particularly worried about conceiving Folk Psychology as a powerful source but not a theory (see, for example, Dennett, 1991 and generally his important contributions to the subject). Moreover, the cognitive phenomenon to be explained, as it appears at the descriptive level, might not be isomorphic to the underlying mechanism processing. Accordingly, it is likely that testing descriptive constructs in such a way can get to a mutual reformulation of both. Finally, mechanistic theories may prove helpful with some psychiatric disturbances, but they hardly apply to all. For example, other psychiatric conditions, usually ascribed to altered inputs (e.g. social, relational, cultural factors) to normal functioning mechanisms, would be cut off. In conclusion, a reformulation of the psychiatric taxonomy in such mechanistic terms would radically change Psychiatry as a discipline.

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## ENDNOTES

1 Craver (2007) distinguishes between *etiological* and *constitutive* mechanistic explanation. He says that the former explains an event by describing its antecedent cause, while the latter explains a phenomenon by describing its underlying mechanism. Such a distinction is unnecessary to my purposes here as psychiatric explanations involve both dimensions.

2 That is what often leads philosophers of talking about *emergence* as a mysterious label. Mechanistic theorists

show different conceptions of emergence (see Bechtel, 2008 and Craver, 2007). Yet they are intrinsically reductionists and believe in no mystery at all.

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