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Review

The goal-directed model as an alternative to reductionist and network approaches of psychopathology

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Abstract

As an alternative to biological reductionist and network approaches to psychopathology, we propose a nonreductionist mental-mechanistic approach. To illustrate this approach, we work out the implications of the goal-directed framework of Moors et al., which has the potential to explain the heterogeneous manifestations of psychopathology with a restricted set of broad theoretical principles.

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Latent variable model, Network model, Reductionism, Psychopathology, Goal-directed.

A current debate in psychopathology centers around two contrasting approaches: the latent variable approach and the network approach. The latent variable approach is a mechanistic approach, characterized as reductionist, in which symptoms of a mental disorder are understood as caused by a single common cause — often a neural deficit, situated at the brain level of analysis. For instance, researchers have tried to identify differential neural substrates for schizofrenia, autistic, and obsessive spectrum disorders [1]. The network approach, on the other hand, proposes that a mental disorder emerges from and is constituted by the causal relations among the symptoms of the disorder (and external factors) and not by an underlying common cause [2]. Proponents of the network approach criticized the latent variable approach because of a lack of direct and indirect evidence for many of the purported neural deficits. Direct evidence is evidence that identifies the neural deficits themselves. Indirect evidence (at least one type of it) is evidence for the coherence of the symptoms belonging to a mental disorder within and across individuals. This is at odds with the heterogeneity in symptom profiles that is typically observed for mental disorders (e.g. depression, anxiety disorder, obsessive-compulsive disorder, and schizophrenia). While the latent variable approach has to invoke extra factors that moderate the relation between the common cause and the symptoms to explain heterogeneity, the network approach only deals with symptoms and is therefore naturally equipped to account for heterogeneity. Another selling point of the network approach is that the nodes in the network have Intentional[1] content (i.e. aboutness; e.g. sadness about job loss). This makes mental disorders meaningful (even if not therefore rational), something that is beyond the reach of reductionist explanations in terms of neural deficits [2].

Although we acknowledge the problems of the latent variable approach, we are not convinced that rejection of this approach necessarily drives us in the arms of the network approach. One set of arguments cautions against the hasty rejection of the mechanistic approach resting on a narrow understanding of this approach as reductionist [3,4]. Leading philosophers of science have convincingly argued that a genuine mechanistic approach is not reductionist but multilevel [5,6]. In psychology, it is useful to distinguish between an observable level, a mental level, and a brain level. The observable level describes relations between observable stimuli and observable behavior. Phenomena (e.g. symptoms) described at the observable level can be explained by mechanisms situated at the mental level and the brain level. In addition, the mental level can play an important role in bridging the observable level

[1] Intentionality is used here in the philosophical sense to indicate the property of mental representations that they can be directed at or about objects outside of themselves. Following Searle [23], we capitalize the term to mark the distinction with intentionality in the ordinary sense, which is applied to actions and processes and indicates that these are caused by intentions.

and the brain level [4]. The type of approach that we propagate specifies these three levels, and their relations are thus without risk of 'explaining away' one of the levels. Furthermore, the mechanistic approach is not committed to the assumption that all symptoms situated at the observable level are generated by a single latent variable, whether mental or neural. This is because mechanisms are typically componential, comprising several latent variables that are causally connected [7]. Things can go wrong in different components for different individuals, and this can account for the heterogeneity of symptoms across people (see the following paragraphs). In sum, the mechanistic approach is not reductionist but multilevel and does not strive for a single common cause but rather a componential mechanism.

Another set of arguments points at shortcomings of existing network models.[2] A first problem is that the nodes in these models, which belong to different levels of analysis (e.g. avoidance behavior at the observable level, fear of spiders at the mental level, amygdala activity at the neural level), are treated as if they belong to the same level of analysis [8]. This is apparent from the fact that the relations between them are seen as causal and not as constitutive. There seems to be no room in existing network models of psychopathology for constitutive relations, except for the relation between symptoms and the emergent disorder.

A second problem is the lack of theoretical principles that guide the choice of the nodes in the network [9,10]. Existing work with the network approach is bottom-up and exploratory. Researchers pick a set of symptoms (and perhaps other factors) with the aim of discovering their causal connections in empirical research, but the selection of symptoms is often based on folk theory [10]. Researchers take not only the content of the nodes at face value but also the causal relations among them. Relations between symptoms are considered valid because they "make sense" [2, p. 5]. However, this type of intuitive reasoning is notoriously unreliable [10]. For example, the causal relation between acute sleep deprivation and euphoria can hardly be considered making intuitive sense [11]. Also contrary to popular belief, feelings of fear and avoidance often diverge, both in the clinic [12] and in the laboratory [13].

Finally, the Intentional content of network nodes (e.g. sadness about job loss) may create a third problem. Different content requires a different network model, so that a plurality of network models is needed [10]. A person whose social anxiety leads to staying home ends up with a different network structure than a person whose fear about job loss leads to working overtime. Yet a proliferation of models is at odds with the aim of nomothetic science to explain the heterogeneous manifestations of psychopathology with a restricted set of broad theoretical principles (combining scope and parsimony), and it may obfuscate that these persons may benefit from a similar type of treatment.

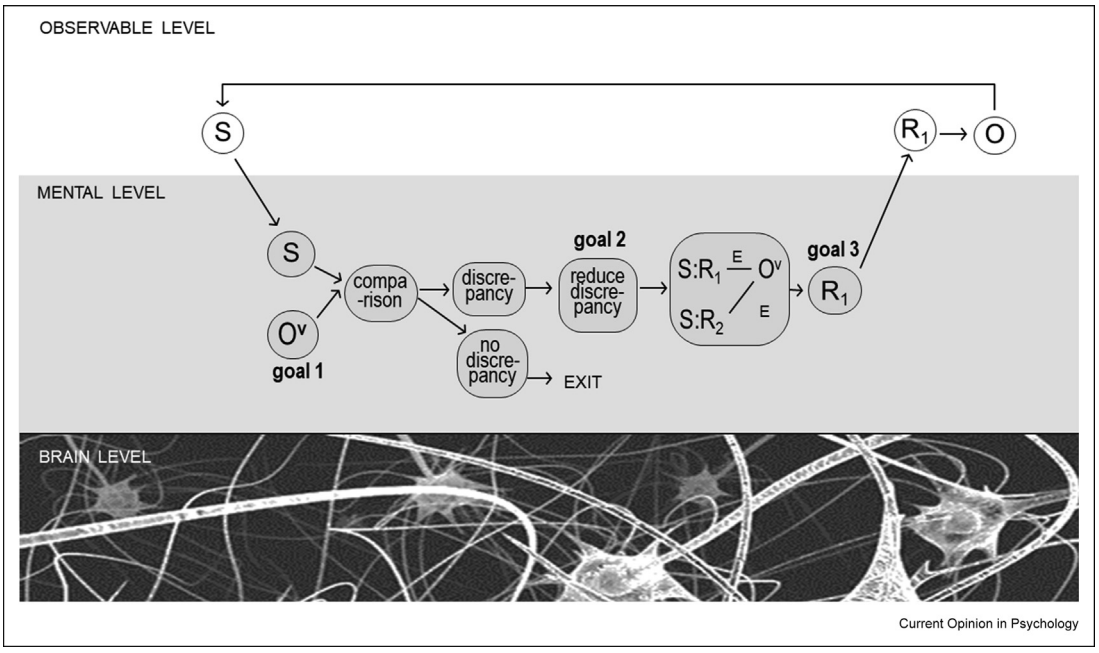
Taken together, we argue that there is merit in a theory-driven mechanistic approach situated at the mental level of analysis that makes abstraction of Intentional content. The promise of this approach is to reveal that various mental disorders follow a single logic despite their apparent heterogeneity and to reveal new treatment directions. We illustrate this by analyzing psychopathology through the goggles of the goal-directed model of behavior causation by Moors et al. [14].

This model proposes a cycle starting with the detection of a discrepancy between a first goal (i.e. the representation of a valued outcome) and a (current or anticipated) stimulus, which can be reduced via the broad strategies of acting (i.e. assimilation), replacing the first goal by a different goal (i.e. accommodation), or biasing the interpretation of the stimulus (i.e. immunization). In the case of assimilation, people select the behavior option from their repertoire with the highest expected utility (i.e. the highest expectancy of reducing the discrepancy and reaching the valued outcome). This activates the corresponding action tendency, which translates into overt behavior and produces an outcome. This outcome is fed back as the stimulus input to the next cycle. The cycle is repeated until the discrepancy is resolved (see Fig. 1).

The suboptimal behavior (and affect) in mental disorders can be understood as stemming from problems in one or more steps of this cycle [15,16]. Aggression (as in impulsive disorders) may be selected as a strategy (assimilation) to solve the discrepancy with a personal goal (e.g. to win an argument), but people may fail to detect that this behavior is itself discrepant with another goal (e.g. to keep their relationship intact). Even if they do detect the discrepancy, they may lack an action option in their repertoire (e.g. negotiating calmly) to reach both goals or they may underestimate the expectancy of such an action option. Crucially, these principles can be abstractly formulated without making reference to a specific goal (which could be to win an argument, but also other goals such as the goal to maintain high social status), contributing in this way to combining scope and parsimony. Another example is relentless yearning for a deceased partner (as in pathological grief [17]). This could be understood as persisting in fruitless approach behavior (i.e. a failure to accommodate). The incapacity to let go may not only pertain to deceased persons (e.g. grief over a broken relationship), or not even to persons at all (e.g. melancholic fixation on the old days). A further example is apathy (as in depression), which could be understood as forsaking to reduce the discrepancy between stimuli and goals altogether, because of previous failures to reduce such discrepancies via behavior (i.e. failure to assimilate [18]) and because the goals are too fundamental to be replaced by other ones (i.e. failure to accommodate). Again, the goals can range

[2] Not all of these shortcomings are principled shortcomings of the network approach.

Figure 1



Goal-directed cycle spanning the observable and mental levels and sustained by the brain level. Note: Steps in the goal-directed cycle spanning the observable level and the mental level include a stimulus (white S) that activates a stimulus representation (gray S), which is compared with the representation of a valued outcome or goal 1 (O^v). In the case of a discrepancy, goal 2 to reduce the discrepancy is activated. If this reduction is done via assimilation, the behavior option (R_1 or R_2) with the highest expectancy to reach the valued outcome given the stimulus is selected from the action repertoire. This behavior option activates its corresponding action tendency or goal 3 (gray R_1). This leads to an actual behavior (white R_1), which produces an actual outcome (white O). The outcome is fed back as the new stimulus to the cycle. Discrepancy reduction can also be done via accommodation or immunization. Adapted from Moors et al. [24].

from obtaining meaningful relationships with others to obtaining a sense of competence at a professional level. Finally, hallucinations or delusions (as in schizophrenia) can be understood as a form of immunization. This would hold for delusions about infatuated others as well as for delusions about being a brilliant scientist. Thus, here as well, the proposed mechanism makes abstraction of content and therefore provides a ground for generalization among heterogeneous manifestations of psychopathology.

Thus, while a network approach takes phenomenological variety at face value and accepts heterogeneity, a mechanistic approach holds the promise of accounting for heterogeneity by use of broad theoretical principles, which could further lead to a reorganization of the landscape of mental disorders (e.g. as per failures in various steps in the goal-directed cycle). As illustrated previously, the type of mechanistic approach that we propagate specifies the relation between the abstract mental level (e.g. assimilation) and the observable level (e.g. staying at home because of the goal to remain disease free) and is thus without risk of explaining away the latter (i.e. reductionism).

The goal-directed model suggests a therapeutic approach in which problems are analyzed with the aim of uncovering and remediating problems in one or more steps of the goal-directed cycle: facilitating discrepancy detection, extending the behavioral repertoire with behavior options that satisfy multiple goals, and changing values (e.g. of family life vs. immediate gratification in addiction) and/or expectancies (e.g. of being able to reach certain goals in depression). In fact, several existing therapies already fit in this approach, but recognizing that they do has the benefit of uniting them and of revealing blind spots.

In sum, we are not convinced that the network approach provides a replacement for theoretical and experimental work on the mechanisms of psychopathology. Some have argued that network models can accommodate any type of content, at all levels of abstraction and all levels of analysis [19,20]. But even if they would, it remains unclear what the network approach would then add over and above the causal relations that are already part of existing nonreductive, mental-level mechanistic theories. The network approach could, in our opinion, still be ancillary to such a mechanistic approach, for instance, by offering a mathematical toolbox [21] for organizing the (causal) relations among the entities at various levels [22].

Credit author statement

Agnes Moors: Conceptualization, Writing – Original Draft, Writing – Review & Editing Yannick Boddez: Conceptualization, Writing – Review & Editing

Conflict of interest statement

Nothing declared.

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