RUNNING HEAD: CHALLENGES AND WAYS FORWARD

On the Challenges of Cognitive Psychopathology Research and Possible Ways Forward: Arguments for a Pragmatic Cognitive Approach

Jan De Houwer

Ghent University, Belgium

In press. Current Opinion in Psychology.

mailing address: Jan De Houwer
Ghent University
Henri Dunantlaan 2
B-9000 Ghent
Belgium
email: Jan.DeHouwer@UGent.be
phone: 0032 9 264 64 45

Abstract

Cognitive psychology had a profound impact on psychopathology research. Nevertheless, the fact that cognition cannot be observed or manipulated directly complicates debates about the nature of the mental mechanisms that mediate psychopathology. This is less troublesome for psychopathology researchers who adopt an explicitly pragmatic approach that aims to use cognitive theories as tools for improving psychotherapy than for psychopathology researchers who seek to establish whether those theories are "correct". A pragmatic cognitive approach fosters progress by encouraging (a) reality-checks aimed at ending unproductive theoretical debates between cognitive theories, (b) a separation between to-be-explained psychological phenomena and explanatory mental constructs, (c) theoretical diversity, and (d) interactions with behavior analysis.

Keywords: cognitive psychology, psychopathology, levels of explanation, behavior analysis

During the past 40 years, many psychopathology researchers borrowed concepts (e.g., inhibition), theories (e.g., dual process theories), and methodologies (e.g., the dot probe task) from cognitive psychology in the hope of better understanding the mental mechanisms that produce psychopathology and thereby ultimately being able to better predict and change the course of psychopathology (e.g., Harvey, Watkins, Mansell, & Shafran, 2004). The idea that knowledge about mediating mental mechanisms is a precondition for better psychotherapy has almost become a mantra within psychopathology research. It would therefore be interesting to evaluate in a systematic manner how much progress we have made in understanding the mental mechanisms underlying psychopathology and, more importantly, whether this progress led to improvements in the prediction and treatment of psychopathology.

Although such a systematic assessment is beyond the scope of the present paper, my own experience indicates that achieving progress at this level is not self-evident. The debates that I have been involved in often remained unresolved (e.g., whether attentional biases play a causal role in anxiety disorders; see Van Bockstaele et al., 2014; whether fear conditioning is mediated by associative or propositional representations; see Mitchell, De Houwer, & Lovibond, 2009) and did not (yet) result in effective new treatment techniques (e.g., disappointing outcomes of cognitive bias modification; see Koster & Bernstein, 2015). This personal evaluation prompted me to reflect on the challenges of cognitive psychopathology research, that is, research aimed at understanding the cognitive underpinnings of psychopathology. Are there reasons why such an approach is challenging? If so, how should we respond to those challenges? The current paper summarizes these reflections.

My starting point is the realization that cognition as information processing is non-physical (see De Houwer, D. Barnes-Holmes, & Y. Barnes-Holmes, 2018, for a discussion), Within cognitive psychology, cognition is typically defined as "all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used" (Neisser, 1967, p. 4). Cognition thus involves mental mechanisms, that is, chains of information processing steps (Bechtel, 2008). As noted by Wiener (1961, p. 132), "information is information, not matter or energy". Hence, cognition cannot be observed or manipulated directly. We might infer it from behavior (in the broad sense of activity of muscles, glands, or the brain) but these inferences always depend on auxiliary assumptions that are difficult to verify. We can intervene in the physical environment (including the physical make-up of individuals) but it is difficult to verify what effects this has on mental representations and processes. [1]

As an example, let us briefly look at research on the role of attention in anxiety disorders. It has been proposed that anxiety disorders are caused and maintained by biases in the mental process of attention allocation (e.g., MacLeod & Mathews, 2012). However, it is still unclear what the concept of attention actually refers to at the mental level (e.g., Anderson, 2011; Hommel et al., 2019). Moreover, it is difficult to validate the tools that are needed to assess (biases in) attention and the procedures for changing (biases in) attention. Consider a dot probe task (e.g., see van Rooijen, Ploeger, & Kret, 2017, for a review) in which participants respond to dots that are preceded by pictures of snakes or chairs. Faster

1 In response to this argument, cognitive psychologist often note that other sciences (e.g., physics) successfully study unobservable entities (e.g., black holes). However, unlike cognitive psychology, these sciences deal with physical entities, which facilitates the development of general laws (e.g., gravity) that also apply to unobservable physical entities. As such, those independently verified general laws can be used to make inferences about these entities (e.g., inferring the presence of a black hole on the basis of its gravitational pull on planets; De Houwer, 2011).

responding to a dot preceded by snakes could be due to faster orienting of attention to snakes but also to slower disengagement of attention away from snakes. It could result from beliefs about the negativity of snakes but also from beliefs about the personal relevance of snakes. Differences in the extent to which snakes facilitate responding in different individuals could reflect differences in the general capacity to ignore task-irrelevant stimuli rather than differences in beliefs about how negative or important snakes are. How quickly someone responds to the dots determines how much opportunity there is for processing of the preceding picture to influence responding. Because (dot probe) performance can be influenced by so many different factors, it is difficult to make backward inferences about one of these factors (e.g., engagement of attention) on the basis of (dot probe) performance. This is true not only for the dot probe task but for any index of mental processes and representations: even when it can be argued that an index is sensitive to a particular mental process or representation, it is unlikely that variations in task performance reflect only variations in that particular mental process or representation (De Houwer, 2011; Poldrack, 2006).

In cognitive psychopathology research, the challenges posed by the non-physical nature of cognition are amplified. If psychopathology researchers want to improve psychotherapy by uncovering the mental mechanisms underlying psychopathology, they not only need to test general theories of psychopathology but also (a) to develop interventions for changing mental processes and representations and (b) to measure and change these processes and representations at the individual level. This means that they need measures that are precise and sensitive enough to capture specific changes as well as interventions that successfully target specific mental processes and representations. Operating at the level of individuals also requires measures that are reliable enough to pick up individual differences

as well as changes within one individual. These challenges seriously complicate any mechanism-based psychotherapy in which treatment relies on assessing (modifications of) biases in mental mechanisms at the individual level (e.g., Holmes, Craske, & Graybiel, 2014).[2]

How should we respond to these challenges? When challenged scientifically, it is good to reflect on one's scientific goals. Arguably, for most psychopathology researchers, cognitive theories are primarily tools for reaching the ultimate aim of reducing psychological suffering. In other words, developing and testing cognitive theories is a proximal goal at the service of a distal goal. From this pragmatic perspective, it is less important whether a cognitive theory is "correct" in an ontological sense (i.e., whether it corresponds to some "true" state of affairs). What matters is whether the theory is useful. Although "correct" theories are probably more useful than "incorrect" ones, it is difficult to be certain that a theory is "correct" or that we will ever have "the correct theory". Hence, from a pragmatic perspective, it makes sense to change Lewin's maxim "there is nothing as practical as a good theory" into "a good theory is a practical theory". As demonstrated throughout the history of science, even theories that at some point turn out to be "incorrect" (e.g., Newtonian physics) can provide useful guidance for research and application. Because the challenges discussed above relate mainly to uncovering the "true" nature of the mental world, they are less troublesome when adopting a pragmatic stance.

Although I believe many psychotherapy researchers would subscribe to such a pragmatic cognitive approach, it is worthwhile to make explicit important implications of

2 Note that also the brain does not provide a direct window into the mind because the same pattern of brain activity could result from multiple mental mechanisms (e.g., Poldrack, 2006; Poldrack & Yarkoni, 2016). Moreover, many neuroscience measures are too unreliable to be used at the individual level (e.g., Elliot et al., 2020).

adopting this approach. I will discuss four implications, each of which can help speed up the rate at which psychopathology research advances psychotherapy. First, proximal goals should be abandoned once it becomes clear that they no longer serve the distal goal. Hence, it is good to step back now and then to consider whether a specific discussion about the cognitive underpinnings of psychopathology continues to serve the distal goal of reducing psychological suffering. Reality-checks like these can save time and resources (De Houwer, Hughes, & D. Barnes-Holmes, 2017). Second, because a pragmatic perspective highlights that cognitive theories are not necessarily "true", it discourages researchers from defining procedures or phenomena in terms of those (potentially incorrect) cognitive theories (e.g., dot probe effects as attentional engagement or conditioning as association formation; De Houwer, 2011). As such, cumulative science is served by consistently separating to-be-explained phenomena from (potentially) explanatory mechanisms (Hempel, 1970). [3] Third, within a pragmatic approach, theoretical diversity is seen as a source of inspiration rather than as a source of conflict (i.e., attacks on the "truth value" of one's own pet theories). A pragmatic approach therefore discourages theoretical myopia and encourages collaborative research. For instance, rather than viewing propositional theories of classical conditioning primarily as a threat to claims about association formation as the "true" mechanism underlying conditioning and (the treatment of) anxiety disorders, one could conceive of propositional theories as

3 A reviewer noted that conflating a phenomenon with an explanatory mechanism might have benefits when the proposed mechanism (more or less) corresponds to the "actual" mechanism. Regardless of the validity of this argument, one should keep in mind that it is difficult to determine whether or to which extent a proposed mental mechanism corresponds to the "actual" mental mechanism. Ultimately, from a pragmatic point of view, also the merits of mechanistic definitions of phenomena will depend the extent to which they help achieve distal goals (e.g., reduce psychological suffering). Although it is difficult to exclude the possibility that defining psychological phenomena in terms of mental mechanisms could sometimes have practical utility, it is good to always be aware of the risks of using such definitions.

providing a novel perspective that highlights novel and potentially useful ideas (De Houwer, 2020).

This brings us to a fourth point, one that is situated at a meta-theoretical level. My colleagues and I have argued that psychologists who view cognitive theories as tools operate at a functional rather than a cognitive level of explanation: their ultimate aim is to predict and influence behavior (in a broad sense that includes conscious thoughts and feelings) rather than to understand the mechanisms that mediate behavior (De Houwer et al., 2017). Importantly, they share this aim with behavior analysts (Catania, 2013; Hayes & Brownstein, 1986; Skinner, 1953). In order to predict and influence behavior, behavior analysts look for general principles in the way that the current and past environment influences behavior (e.g., the principle of reinforcement). [4] They formulate these principles using abstract terms that refer to the function of events (e.g., discriminative stimulus, reinforcer) and apply these principles and concepts to specific instances of behavior (i.e., they perform analytic-abstractive functional analyses; De Houwer et al., 2017; Hughes, De Houwer, & Perugini, 2016). Behavior analysts, however, do not refer to mental constructs. For cognitive psychologists who aim to uncover the "true" nature of mental mechanisms, this is often sufficient reason for not interacting with behavior analysts (e.g., Miller, 2003). From a pragmatic cognitive perspective, however, there is only a difference in opinion about whether cognitive theories provide useful tools for increasing prediction and influence. This difference in opinion should not stop psychotherapy researchers from exploring whether they

4 The concept "reinforcement" is often confused with the concept "rewarding". Whereas the former describes that the frequency of behavior increases because of a particular outcome of that behavior, the latter implies an explanation of this effect (e.g., that the outcome contains some special property by which it can increase the frequency of behavior that produces this outcome). This confusion resulted in misguided debates about whether reinforcement (in the mental sense of providing rewards) is an effective tool for behavior change (see De Houwer & Hughes, 2020, Box 3.6).

can benefit from interacting with behavior analysts who also want to predict and change the course of psychopathology. Embracing diversity is beneficial not only at the level of cognitive theories but also at the level of scientific approaches. Interactions with behavior analysts cannot only provide inspiration for new ways of predicting and changing the course of psychopathology but can also help cognitive researchers talk about psychological phenomena without using mental constructs (e.g., referring to attentional bias as selective stimulus control; see Liefooghe & De Houwer, 2016, for a related example), thereby separating the to-be-explained phenomenon from explanatory concepts. As De Houwer et al. (2017) argued, such interactions would help combine the strengths of the cognitive and behavior analytic approach. [5]

In sum, uncovering the "true" nature of the mental mechanisms that underlie psychopathology is a daunting task. In response to this challenge, psychopathology researchers could adopt an explicitly pragmatic approach in which cognitive theories are used as tools at the service of the ultimate goal of reducing psychological suffering. Such a

5 Some psychopathology researchers might accept these arguments in principle but still object that behavior analysis has little added value for them in practice because functional analyses without mental constructs cannot capture the full complexity of behavior. Although I certainly agree that traditional behavior analytic concepts like reinforcement have their limitations, one should not underestimate the power of analytic-abstractive functional analyses. Much of their power resides in selecting the units that delineate stimulus and response classes (see De Houwer & Hughes, 2020, Chapters 3 and 5). As an illustration, consider the issue of causal mediation. It is often argued that knowledge about mechanisms is crucial because it reveals mediators. For instance, eating oranges is known to prevent scurvy (i.e., a functional relation). If it can be shown that the effect of oranges is mediated by the amount of vitamin C contained within the orange, one can infer that other sources of vitamin C (e.g., vitamin pills) will also prevent scurvy (Pearl & Mackenzie, 2018). From a behavior analytic perspective, however, what matters is the unit by which the stimulus class that prevents scurvy is delineated. If the unit "contains vitamin C" turns out to be more useful than the unit "has an orange color and shape" then former unit should be used to delineate the stimulus class. There is no need to refer to the idea of mediation or mechanisms to improve control in this manner. Like the search for mechanisms, the search for the most useful analytic-abstractive functional analysis is a continuing and intellectually challenging mission. When judging the power of these analyses, one should also take into account that behavior analysis can encompass covert behavior (i.e., conscious thoughts and feelings; Skinner, 1963) and behavior-behavior mechanisms (but see Hayes & Brownstein, 1986). Moreover, it has continued to develop over the past decades (e.g., new concepts for analyzing verbal behavior; see Hayes, D. Barnes-Holmes, & Roche, 2001) and is likely to continue to develop (e.g., by integrating network theories within functional analyses; see Borsboom, 2017; Van Dessel et al., 2018).

pragmatic cognitive approach is promising because it encourages (a) regular reality-checks, (b) the separation of phenomena and cognitive theory, (c) theoretical diversity, and (d) closer interactions with behavior analysis.

References

Anderson, B. (2011). There is no such thing as attention. *Frontiers in Psychology, 2*, 1–8. https://doi.org/10.3389/fpsyg.2011.00246

Bechtel, W. (2008). *Mental mechanisms: Philosophical perspectives on cognitive neuroscience*. London: Routledge.

Borsboom, D. (2017). A network theory of mental disorders. *World Psychiatry, 16*, 5-13.

Catania, A. C. (2013). *Learning* (5th ed.). Cornwall-on-Hudson, NY: Sloan Publishing.

De Houwer, J. (2011). Why the cognitive approach in psychology would profit from a functional approach and vice versa. *Perspectives on Psychological Science, 6*, 202-209.

* De Houwer, J. (2020). Conditioning is more than association formation: On the different ways in which conditioning research is valuable for clinical psychology. *Collabra: Psychology, 6*(1): 2. DOI: https://doi.org/10.1525/collabra.239

Provides an overview of different theoretical perspectives on conditioning and the relevance of conditioning for clinical psychology.

* De Houwer, J., Barnes-Holmes, D., & Barnes-Holmes, Y. (2018). What is cognition? A functional-cognitive perspective. In S. C. Hayes & S. G. Hofmann (Eds.), *Process-Based CBT* (pp. 119-135). Oakland, CA: New Harbinger.

Discusses the meaning of the term “cognition” from both a functional and a cognitive perspective. It also highlights that functional and cognitive research on cognition can be mutually beneficial.

** De Houwer, J., & Hughes, S. (2020). *The psychology of learning: An introduction from a functional-cognitive perspective.* Cambridge, MA: MIT Press.

In this book, the authors provide a detailed discussion of the nature of and relation

between the functional and cognitive approaches in learning research, an overview of the main insights produces by both approaches, and the application of learning research for solving real-life problems such as psychological suffering.

De Houwer, J., Hughes, S., & Barnes-Holmes, D. (2017). Psychological engineering: A functional-cognitive perspective on applied psychology. *Journal of Applied Research in Memory and Cognition, 6,* 1-13.

* Elliott, M. L., Knodt, A. R., Ireland, D., Morris, M. L., Poulton, R., Ramrakha, S., Sison, M. L., Moffitt, T. E., Caspi, A., & Hariri, A. R. (2020). What is the test-retest reliability of common task-functional MRI measures? New empirical evidence and a meta-analysis. *Psychological Science, 31,* 792-806.

This paper highlights major problems with using fMRI measures to capture differences between individuals. As such, it illustrates the difficulties of developing valid measures of individual differences that are needed within a mechanistic approach to psychopathology.

Harvey, A.G., Watkins, E., Mansell, W. & Shafran, R. (2004). *Cognitive behavioural processes across psychological disorders: A transdiagnostic approach to research and treatment.* Oxford, UK: Oxford University Press.

Hayes, S. C., Barnes-Holmes, D., & Roche, B. (Eds.). (2001). *Relational Frame Theory: A Post-Skinnerian account of human language and cognition*. New York: Plenum Press.

Hayes, S. C., & Brownstein, A. J. (1986). Mentalism, behavior-behavior relations, and a behavior-analytic view of the purposes of science. *The Behavior Analyst, 9,* 175-190.

Hempel, C.G. (1970). *Aspects of scientific explanation and other essays in the philosophy of science*. New York: Free Press.

Holmes, E. A., Craske, M. G., & Graybiel, A. M. (2014). Psychological treatments: A call for

mental-health science. *Nature, 511,* 287-289. doi: 10.1038/511287a.

* Hommel, B., Chapman, C.S., Cisek, P., Neyedli, H.F., Song, J.-H., & Welsh, T.N. (2019). No one knows what attention is. *Attention, Perception, & Psychophysics, 81*, 2288-2303.

Provides an in depth discussion of the problems with the concept "attention". The insights put forward in this paper illustrate the conceptual problems inherent to a cognitive approach in psychology.

Hughes, S., De Houwer, J., & Perugini, M. (2016). The functional-cognitive framework for psychological research: Controversies and resolutions. *International Journal of Psychology, 51*, 4-14.

Koster, E. H. W., & Bernstein, A. (Eds.). (2015). Cognitive bias modification: Challenges and new directions. *Journal of Behavior Therapy and Experimental Psychiatry, 49* (Special issue).

Liefooghe, B., & De Houwer, J. (2016). A functional approach for research on cognitive control: Analyzing cognitive control tasks and their effects in terms of operant conditioning. *International Journal of Psychology, 51*, 28-32.

MacLeod, C., & Mathews, A. (2012). Cognitive bias modification approaches to anxiety. *Annual Review of Clinical Psychology, 8*, 189-217.

Miller, G. A. (2003). The cognitive revolution: a historical perspective. *Trends in Cognitive Sciences, 7*, 141–144.

Mitchell, C. J., De Houwer, J., & Lovibond, P. F. (2009). The propositional nature of human associative learning. *Behavioral and Brain Sciences, 32*, 183-198.

Neisser, U. (1967). *Cognitive Psychology*. New York: Appleton-Century-Crofts.

* Pearl, J. & Mackenzie, D. (2018). *The book of why*. New York: Basic Books.

This excellent book reviews the history of research on causality and the answers that causal models provide for many of the problems that plagued the science of causality. Although not discussed explicitly by the authors, many of the problems were due to a mechanistic conceptualization of causality and many of the solutions follow from a functional (i.e., counterfactual) definition of causality.

Poldrack, R.A. (2006). Can cognitive processes be inferred from neuroimaging data? *Trends in Cognitive Sciences, 10*, 59–63.

Poldrack, R. A., & Yarkoni, T. (2016). From brain maps to cognitive ontologies: Informatics and the search for mental structure. *Annual Review of Psychology, 67*, 587–612.

Skinner, B. F. (1953). *Science and human behavior*. New York: MacMillan.

Skinner, B. F. (1963). Behaviorism at fifty. *Science, 140*, 951-58.

* Van Dessel, P., De Houwer, J., Hughes, S., & Hussey, I. (2018). An analysis of the scientific status and limitations of the attitudinal entropy framework and an initial test of some of its empirical predictions. *Psychological Inquiry, 29*, 213-217.

Discusses, amongst other issues, how network models often fail to distinguish between functional and cognitive levels of explanation. The authors argue that the true potential of network models in psychology can be reached only if networks are firmly entrenched within the functional level of explanation.

Van Bockstaele, B., Verschuere, B., Tibboel, H., De Houwer, J., Crombez, G., & Koster, E. (2014). A review of current evidence for the causal impact of attentional bias on fear and anxiety. *Psychological Bulletin, 140*, 682-721.

van Rooijen, R., Ploeger, A. & Kret, M. (2017). The dot-probe task to measure emotional attention: A suitable measure in comparative studies? *Psychonomic Bulletin and Review, 24*, 1686–1717.

Wiener, N. (1961). *Cybernetics, or control and communication in animal and machine* (2nd Edition). Cambridge, MA: MIT press.

Acknowledgements

Jan De Houwer, Ghent University, Ghent, Belgium. Correspondence should be addressed to Jan De Houwer, Ghent University, Henri Dunantlaan 2, B-9000 Ghent, Belgium. Electronic mail can be sent to Jan.DeHouwer@UGent.be . The preparation of this paper was made possible by Ghent University Grant BOF16/MET_V/002 to Jan De Houwer. I thank Yannick Boddez for feedback on an earlier version of the paper. Several of the ideas put forward in this paper were shaped during conversations with Dermot Barnes-Holmes and Sean Hughes.

Funding Information

The preparation of this paper was made possible by Ghent University Grant BOF16/MET_V/002 to Jan De Houwer.

Declaration of interest: none