RUNNING HEAD: THOUGHT AS RELATING

# Putting relating at the core of language of thought

Jan De Houwer

Ghent University, Belgium

*In press. Behavioral and Brain Sciences. [Commentary on Quilty-Dunn, J., Porot, N., & Mandelbaum, E. (this issue). The best game in town: The re-emergence of the language of thought hypothesis across the cognitive sciences. Behavioral and Brain Sciences.]*

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**

Propositional representations are units of information with a relational content. Their relational nature allows for the six distinctive properties of language of thought representations. Putting relating at the core of language of thought also fits well with the idea that thinking and reasoning are instances of relational behavior. These propositional and behavioral perspectives can be combined within a functional-cognitive framework.

I agree with Quilty-Dunn et al. (this issue) that, from a cognitive point of view, thinking in human and non-human organisms relies on language-like structured representations. In my own work, I have referred to these representations as propositional representations. For many years now (e.g., De Houwer, 2009, 2014; Boddez et al., 2017), my colleagues and I have argued that seemingly simple phenomena such as conditioning, implicit evaluation, and habitual responding are mediated by this type of representations (see De Houwer, 2019, for a review). In line with Quilty-Dunn et al., we pointed out that propositional representations do not necessarily have the same structure as natural language and therefore can be present also in nonverbal organisms (De Houwer et al., 2016). Rather than focusing on the many communalities between our views, in this commentary, I highlight a few differences so as to further stimulate the scientific debate on the nature of thought.

Whereas Quilty-Dunn et al. (this issue) put forward six distinctive properties of "language of thought" representations, I have characterized propositional representations in terms of one core property: their relational nature (e.g., De Houwer, 2018; also see Lagnado et al., 2007). More specifically, a propositional representation can be defined as a unit of information with a relational content. In principle, this information can be implemented in many physical vehicles (e.g., a brain, an artificial associative network) but it needs to specify the way in which elements in the world are related (e.g., element A "is a", "has a", "belongs to", "causes", "predicts", … element B). In my opinion, the properties put forward by Quilty-Dunn et al. are implied by this one core property: Relating requires discrete constituents (e.g., elements A and B), requires role-filler independence (e.g., whether A is the cause or the effect of B), is truth-evaluable (e.g., to evaluate whether A is a cause of B), allows for logical operators (e.g., A AND B causes C), allows for inferential promiscuity (e.g., to infer that B will follow A), and allows for abstract conceptual content (e.g., the concept of causality). It

would be interesting to know whether Quilty-Dunn et al. see any reason for not putting relating at the core of language of thought representations.

A second way in which my work deviates from that of Quilty-Dunn et al. (this issue) is that I adopt a functional-cognitive framework in which psychological phenomena are conceived of in behavioral terms (De Houwer, 2011; Hughes et al., 2016a). From this perspective, psychological phenomena can be mediated by propositional representations but can also be studied without referring to any type of representation. Whereas Quilty-Dunn et al. refer to Skinner's behaviorism as a relic, my colleagues and I see much merit in the work of Skinner and those inspired by Skinner. In particular, we have linked our propositional theories to Relational Frame Theory (RFT), which builds on the work of Skinner but goes beyond this work by postulating the concept of Arbitrarily Applicable Relational Responding (AARR; Hayes et al., 2001). Relational responding is responding to one stimulus in terms of another stimulus. It can be grounded in non-arbitrary features (e.g., physical features or direct training with those features) as is the case when a rat presses a lever for food as a function of the relative length of lines (e.g., if a blue line is longer than a red line). Humans, however, can also respond relationally in arbitrarily applicable ways (i.e., not grounded in physical features or direct training with those features). For instance, they can select a dime as being more than a nickel in terms of monetary value even though a dime is less than a nickel in terms of size.

The ideas of behavioral researchers like Skinner (1953) and Hayes et al. (2001) played a vital role in our research on conditioning, implicit evaluation, and habitual responding. When my colleagues and I started this research, these phenomena were often defined in terms of associative representations (e.g., conditioning as the formation of associations in memory). By adhering to behavioral definitions of those phenomena (e.g.,

conditioning as the impact of stimulus pairings on behavior), we could at least raise the possibility that these phenomena are mediated by propositional representations (see De Houwer, 2019; De Houwer et al., 2021). Moreover, it allowed us to link those phenomena with the literature on AARR (e.g., De Houwer et al., in press; Hughes et al., 2016b).

In line with the ideas of Skinner (1953) and Hayes et al. (2001), I believe that there is merit in adopting a behavioral perspective on thinking and reasoning in general. It would imply that thinking and reasoning, like other behaviors, are a function of their antecedents and consequences (see De Houwer, 2022, for a discussion). From the perspective of RFT, thinking and reasoning are covert forms of one specific type of behavior: AARR. Because of its emphasis on relational responding, a behavioral RFT perspective on thinking and reasoning is highly compatible with the cognitive idea that thinking and reasoning rely on propositional (i.e., relational) representations (also see McLoughlin et al., 2020). The added value of adopting this behavioral perspective on thinking and reasoning is that it (a) offers a new way of talking about thinking and reasoning that is abstract, precise, and separated from folk psychology terms, (b) sheds new light on the difference in thinking and reasoning in verbal and non-verbal organisms (De Houwer et al., 2016), (c) allows researchers to relate knowledge about the moderators of AARR to knowledge about thinking and reasoning, which (d) includes ideas about how thinking and reasoning is shaped during the learning history of organisms (and therefore how developmental deficits in thinking and reasoning can be remedied; De Houwer et al., in press). I therefore hope that cognitive scientists will explore and exploit what a behavioral perspective on thinking and reasoning has to offer.

## References

Boddez, Y., De Houwer, J., & Beckers, T. (2017). The inferential reasoning theory of causal learning: Towards a multi-process propositional account. In M. Waldmann (Ed.), *The Oxford Handbook of Causal Reasoning* (pp. 1-22). Oxford, UK: Oxford University Press.

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. (2009). The propositional approach to associative learning as an alternative for association formation models. *Learning & Behavior, 37*, 1-20.

De Houwer, J. (2014). A Propositional Model of Implicit Evaluation. *Social and Personality Psychology Compass, 8*, 342-353.

De Houwer, J. (2018). Propositional models of evaluative conditioning. *Social Psychological Bulletin, 13(3*), Article e28046. https://doi.org/10.5964/spb.v13i3.28046

De Houwer, J. (2019). Moving beyond the distinction between System 1 and System 2: Conditioning, implicit evaluation, and habitual responding might also be mediated by relational knowledge. *Experimental Psychology, 66*, 257-265.

De Houwer, J. (2022). *On the Merits and Challenges of Treating Conscious and Unconscious Thoughts and Feelings as Behavior*. PsychArchives. https://doi.org/10.23668/psycharchives.5332

De Houwer, J., Finn, M., Raemaekers, M., Cummins, J., & Boddez, Y. (in press). Thinking of learning phenomena as instances of relational behavior. *Learning & Behavior*.

De Houwer, J., Hughes, S., & Barnes-Holmes, D. (2016). Associative learning as higher-order cognition: Learning in human and nonhuman animals from the perspective of propositional theories and Relational Frame Theory. *Journal of Comparative Psychology, 130*, 215-225.

De Houwer, J., Van Dessel, P., & Moran, T. (2021). Attitudes as propositional representations. *Trends in Cognitive Sciences, 25*, 870-882.

Hayes, S. C., Barnes-Holmes, D., & Roche, B. (2001). *Relational frame theory: A post-Skinnerian account of human language and cognition.* Kluwer.

Hughes, S., & Barnes-Holmes, D. (2016). Relational frame theory: The basic account. In S. Hayes, D. Barnes-Holmes, R. Zettle, and T. Biglan (Eds.), *Handbook of Contextual Behavioral Science* (pp. 129–178). Wiley.

Hughes, S., De Houwer, J., & Barnes-Holmes, D. (2016a). The moderating impact of distal regularities on the effect of stimulus pairings: A novel perspective on evaluative conditioning. *Experimental Psychology, 63*, 20-44.

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

Lagnado, D. A., Waldmann, M. R., Hagmayer, Y., & Sloman, S. A. (2007). Beyond covariation: Cues to causal structure. In A. Gopnik & L. Schulz (Eds.), *Causal learning: Psychology, philosophy, and computation* (pp. 154-172). Oxford University Press.

McLoughlin, S., Tyndall, I., & Pereira, A. (2020). Convergence of multiple fields on a relational reasoning approach to cognition. *Intelligence, 83,* 101491.

Quilty-Dunn, J., Porot, N., & Mandelbaum, E. (this issue). The best game in town: The re-emergence of the language of thought hypothesis across the cognitive sciences. *Behavioral and Brain Sciences*.

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

**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 .

**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**