

Volume 9, n 2, 2021

Report

Using Prediction Error to Account for the Pervasiveness of Mood Congruent Thoughts

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Keywords:

Depression; Negatively Valenced Thoughts; Prediction Error; Associative Learning.

Received: 17 June 2021

Accepted: 1 July 2021

Published: 8 August 2021

Citation: Myles, L.A.M. (2021). Using Prediction Error to Account for the Pervasiveness of Mood Congruent Thoughts. *Mediterranean journal of Clinical Psychology*, 9(2). <https://doi.org/10.13129/2282-1619/mjcp-3130>

Depression represents one of the most common psychological difficulties across the globe, with 21.2% of people receiving a diagnosis of major depressive disorder at some point in their lives (Auerbach et al., 2018). One of the core symptoms of depression, and psychological difficulties more generally, concerns the possession of negatively valenced thoughts (Frewen et al., 2008; Hjemdal et al., 2013; Johnstone & Dallos, 2013; Myles et al., 2020; Westbrook et al., 2011). In a recent paper in the *Mediterranean Journal of Clinical Psychology*, Myles (2021) highlighted the critical importance of explicating the cognitive mechanisms underpinning psychological difficulties. This paper will discuss how the principles of associative learning can be used to account for the pervasiveness of negative thoughts in individuals with psychological difficulties.

Rescorla-Wagner (1972) Model of Learning

In order to discuss the cognitive mechanisms underpinning the possession of negatively valenced thoughts in individuals with symptoms of depression, it is important to understand the basis of learning. One of the most influential models of learning was proposed by Rescorla and Wagner (1972), which can be summarised with the equation, $\Delta V = \alpha\beta (\lambda - \Sigma V)$. In this model, 'ΔV' pertains to increments in learning. The salience of the stimuli is represented by 'α' and 'β'. 'λ' concerns the total amount of associative strength that can be acquired by an unconditioned stimulus, referring to a stimulus that can alter one's propensity to repeat an

action. Finally, the total associative strength of all conditioned stimuli, referring to neutral stimuli that have been associated with an outcome, is represented by ΣV . From a more qualitative standpoint, this model argues that a prediction error, referring to an incongruity between one's expectations and the *true* events that occur in an environment, results in learning.

Whilst an in-depth evaluation of the Rescorla-Wagner (1972) model of associative learning is beyond the scope of this paper, it is important to note that this model has received an abundance of empirical support (Miller et al., 1995; Myles, 2020; Siegel & Allan, 1996; Walkenbach & Haddad, 1980). Indeed, psychologists have since advanced the model with developments in conceptualisations of learning (Dickinson, 2001; Grossberg, 1982; Le Pelley, 2004; Mackintosh, 1975; Pearce & Hall, 1980; Schultz & Dickinson, 2000). Nevertheless, prediction error remains one of the core cognitive mechanisms underpinning learning, such that discrepancies between one's expectancies and reality influence human cognition.

Using Prediction Error to Account for Negative Thoughts

Despite evidence of the pervasiveness of negative thoughts in individuals with a diagnosis of depression (Frewen et al., 2008; Hjemdal et al., 2013; Johnstone & Dallos, 2013; Myles et al., 2020; Westbrook et al., 2011), there is limited understanding of the cognitive mechanisms underpinning these symptoms. This paper will demonstrate how the principles of prediction error can be used to account for the pervasiveness of negative thoughts in individuals with a diagnosis of depression.

Humans experience an incalculably large number of thoughts each day, the majority of which are not consciously generated and occur spontaneously (Westbrook et al., 2011). Accordingly, not all thoughts can be accepted as reflections of reality. Contemporary literature indicates that the perceived validity of thoughts is influenced by one's mood, with currently active core beliefs reciprocally influencing one's emotions (Clore & Huntsinger, 2007; Clore et al., 2001; Dunn & Schweitzer, 2005; Frijda et al., 2000; Pham, 2004; Taylor, 2001; Westbrook et al., 2011). Critically, this research indicates that individuals hold many, often conflicting (Johnstone & Dallos, 2013; Westbrook et al., 2011), core beliefs, but the extent to which they influence our cognitions, emotions and behaviour varies depending on the extent to which they are currently active. Accordingly, one is more likely to endorse more positive thoughts if one is in a positive mood, and vice versa. Emerging evidence indicates that thoughts are more likely to be perceived as *true* if they are congruent with individuals' moods and/or their currently active core beliefs (Briñol et al., 2018; Clore & Huntsinger, 2007; Clore & Parrott, 2020; Clore et al., 2001; Mayer et al., 1992; Petty & Briñol, 2015; Roberts & Hutcherson, 2019). In other words, the perceived validity of a cognition is influenced by the congruence of the emotional valence and/or content

of the cognition with one's current mood and/or currently active core beliefs, respectively. For example, the perceived validity of the thought that one is worthless is likely to be greater if the individual is currently in a negatively valenced mood, such as sadness, than if one is in a positively valenced mood, such as happiness. This hypothesis indicates that a greater discrepancy, or prediction error, may result in a greater propensity to refute the thought as *false*, and vice versa.

Whilst this mechanism provides an explanation of the cognitive mechanisms used to perceive the validity of a thought, they do not link this mechanism to the phenomenological experience of believing the thought. Mackintosh (1975) argued that conditioned stimuli that provide more accurate predictors of unconditioned stimuli, such that there is a smaller prediction error between the two stimuli, acquire greater salience. A similar mechanism can be applied to cognition, with the suggestion that thoughts that are more congruent with current mood and/or currently active core beliefs may acquire greater salience. If thoughts that are more consistent with mood acquire greater salience, and by virtue of this occupy a greater proportion of conscious attention, thoughts that are consistent with one's mood and/or currently active core beliefs would be phenomenologically experienced as more pervasive. Indeed, this is exactly in line with the aforementioned data (Briñol et al., 2018; Clore & Huntsinger, 2007; Clore & Parrott, 2020; Clore et al., 2001; Dunn & Schweitzer, 2005; Frijda et al., 2000; Mayer et al., 1992; Petty & Briñol, 2015; Pham, 2004; Roberts & Hutcherson, 2019; Taylor, 2001; Westbrook et al., 2011).

Clinical Implications

As discussed by Myles (2021), it is critical that psychologists continue to research the cognitive mechanisms underpinning psychological difficulties (Haselgrove & Hogarth, 2013). Understanding the respective mechanisms will lead to the development of more unified models of psychological difficulties, linking the cognitive mechanisms with the phenomenological experience of mental health difficulties. Indeed, understanding these mechanisms will aid the development of novel therapeutic interventions and improve our ability to support individuals with psychological difficulties.

Moreover, explaining this mechanism to clients facing psychological difficulties can serve to validate their experiences and normalise their symptoms, which has been demonstrated to have a positive impact on mental health (Johnstone & Dallos, 2013; Tarrrier et al., 2000; Westbrook et al., 2011). For example, if a client feels that they have only had negative experiences in the past, they may feel invalidated and disempowered if a therapist challenges their beliefs by presenting examples of occasions in which positive events have happened. However, explaining

why they are experiencing a negative perception of their environment may assist clinicians in validating and normalising their clients' experiences.

Concluding Comments

Overall, this theory suggests that the cognitive mechanisms governing associative learning can account for the pervasiveness of negative thoughts in individuals with psychological difficulties, such as depression. Specifically, this paper argues that the perceived validity of a cognition is influenced by the congruence of the emotional valence and/or content of the cognition with one's current mood and/or currently active core beliefs, respectively. Moreover, it is suggested that thoughts that are of greater congruence with current mood and/or currently active core beliefs may acquire greater salience and are consequently phenomenologically experienced as more pervasive. Future research must endeavour to validate the theoretical propositions outlined in this paper.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any potential conflict of interest.

References

1. Auerbach, R. P., Mortier, P., Bruffaerts, R., Alonso, J., Benjet, C., Cuijpers, P., & Murray, E. (2018). WHO World Mental Health Surveys International College Student Project: Prevalence and distribution of mental disorders. *Journal of abnormal psychology*, 127(7), 623-638. <https://doi.org/10.1037/abn0000362>
2. Briñol, P., Petty, R. E., Stavradi, M., Lamprinakos, G., Wagner, B., & Díaz, D. (2018). Affective and cognitive validation of thoughts: An appraisal perspective on anger, disgust, surprise, and awe. *Journal of Personality and Social Psychology*, 114(5), 693-718. <https://doi.org/10.1037/pspa0000118>
3. Clore, G. L., & Huntsinger, J. R. (2007). How emotions inform judgment and regulate thought. *Trends in cognitive sciences*, 11(9), 393-399. <https://doi.org/10.1016/j.tics.2007.08.005>
4. Clore, G. L., & Parrott, W. G. (2020). Moods and their vicissitudes: Thoughts and feelings as information. In *Emotion and social judgments* (pp. 107-123). Garland Science. <https://doi.org/10.4324/9781003058731-8>
5. Clore, G. L., Gasper, K., & Garvin, E. (2001). Affect as information. In *Handbook of affect and social cognition*, 121-144.
6. Dickinson, A. (2001). The 28th Bartlett memorial lecture causal learning: An associative analysis. *The Quarterly Journal of Experimental Psychology Section B*, 54(1b), 3-25. <https://doi.org/10.1080/02724990042000010>
7. Dunn, J. R., & Schweitzer, M. E. (2005). Feeling and believing: the influence of emotion on trust. *Journal of personality and social psychology*, 88(5), 736-748. <https://doi.org/10.1037/0022-3514.88.5.736>
8. Frewen, P. A., Evans, E. M., Maraj, N., Dozois, D. J., & Partridge, K. (2008). Letting go: Mindfulness and negative automatic thinking. *Cognitive therapy and research*, 32(6), 758-774. <https://doi.org/10.1007/s10608-007-9142-1>
9. Frijda, N. H., Manstead, A. S., & Bem, S. E. (2000). *Emotions and belief: How feelings influence thoughts*. Cambridge University Press. <https://doi.org/10.1017/cbo9780511659904.001>
10. Grossberg, S. (1982). Processing of expected and unexpected events during conditioning and attention: a psychophysiological theory. *Psychological review*, 89(5), 529-572. <https://doi.org/10.1037/0033-295x.89.5.529>
11. Haselgrove, M., & Hogarth, L. (Eds.). (2013). *Clinical applications of learning theory*. Psychology Press. <https://doi.org/10.4324/9780203803509>
12. Hjemdal, O., Stiles, T., & Wells, A. (2013). Automatic thoughts and meta-cognition as predictors of depressive or anxious symptoms: A prospective study of two trajectories. *Scandinavian journal of psychology*, 54(2), 59-65. <https://doi.org/10.1111/sjop.12010>
13. Johnstone, L., & Dallos, R. (2013). *Formulation in psychology and psychotherapy: Making sense of people's problems*. Routledge. <https://doi.org/10.4324/9780203380574>
14. Le Pelley, M. E. (2004). The role of associative history in models of associative learning: A selective review and a hybrid model. *The Quarterly Journal of Experimental Psychology Section B*, 57(3b), 193-243. <https://doi.org/10.1080/02724990344000141>
15. Mackintosh, N. J. (1975). A theory of attention: Variations in the associability of stimuli with reinforcement. *Psychological review*, 82(4), 276-298. <https://doi.org/10.1037/h0076778>
16. Mayer, J. D., Gaschke, Y. N., Braverman, D. L., & Evans, T. W. (1992). Mood-congruent judgment is a general effect. *Journal of personality and social psychology*, 63(1), 119-132. <https://doi.org/10.1037/0022-3514.63.1.119>

17. Miller, R. R., Barnet, R. C., & Grahame, N. J. (1995). Assessment of the Rescorla-Wagner model. *Psychological bulletin*, 117(3), 363-386. <https://doi.org/10.1037/0033-2909.117.3.363>
18. Myles, L. A. M. (2020). Robert Rescorla: A Legacy to Learning. *Technology Networks*.
<https://www.technologynetworks.com/neuroscience/articles/robert-rescorla-a-legacy-to-learning-336682>
19. Myles, L. A. M. (2021). Opinion Article: The Emerging Role of Computational Psychopathology in Clinical Psychology. *Mediterranean Journal of Clinical Psychology*, 9(1). <https://doi.org/10.6092/2282-1619/mjcp-2895>
20. Myles, L. A. M., Connolly, J., & Stanulewicz, N. (2020). The Mediating Role of Perceived Control and Desire for Control in the Relationship between Personality and Depression. *Mediterranean Journal of Clinical Psychology*, 8(3). <https://doi.org/10.6092/2282-1619/mjcp-2589>
21. Pearce, J. M., & Hall, G. (1980). A model for Pavlovian learning: variations in the effectiveness of conditioned but not of unconditioned stimuli. *Psychological review*, 87(6), 532-552. <https://doi.org/10.1037/0033-295x.87.6.532>
22. Petty, R. E., & Briñol, P. (2015). Emotion and persuasion: Cognitive and meta-cognitive processes impact attitudes. *Cognition and Emotion*, 29(1), 1-26. <https://doi.org/10.1080/02699931.2014.967183>
23. Pham, M. T. (2004). The logic of feeling. *Journal of Consumer Psychology*, 14(4), 360-369.
https://doi.org/10.1207/s15327663jcp1404_5
24. Rescorla, R. A. (1972). A theory of Pavlovian conditioning: Variations in the effectiveness of reinforcement and nonreinforcement. *Current research and theory*, 64-99.
25. Roberts, I. D., & Hutcherson, C. A. (2019). Affect and decision making: insights and predictions from computational models. *Trends in cognitive sciences*, 23(7), 602-614. <https://doi.org/10.1016/j.tics.2019.04.005>
26. Schultz, W., & Dickinson, A. (2000). Neuronal coding of prediction errors. *Annual review of neuroscience*, 23(1), 473-500. <https://doi.org/10.1146/annurev.neuro.23.1.473>
27. Siegel, S., & Allan, L. G. (1996). The widespread influence of the Rescorla-Wagner model. *Psychonomic Bulletin & Review*, 3(3), 314-321. <https://doi.org/10.3758/bf03210755>
28. Tarrier, N., Wells, A., Haddock, G., & Davidson, J. (2000). *Treating complex cases: The cognitive behavioural therapy approach*. Chichester, England: John Wiley and Sons. <https://doi.org/10.1891/0889-8391.14.4.410>
29. Taylor, E. W. (2001). Transformative learning theory: A neurobiological perspective of the role of emotions and unconscious ways of knowing. *International Journal of Lifelong Education*, 20(3), 218-236.
<https://doi.org/10.1080/02601370110036064>
30. Walkenbach, J., & Haddad, N. F. (1980). The Rescorla-Wagner theory of conditioning: A review of the literature. *The Psychological Record*, 30(4), 497-509. <https://doi.org/10.1007/bf03394701>
31. Westbrook, D., Kennerley, H., & Kirk, J. (2011). *An introduction to cognitive behaviour therapy: Skills and applications*. Sage. <https://doi.org/10.1017/s1352465808004165>



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DOI: 10.13129/2282-1619/mjcp-3130