

## MENTAL IMAGERY AND IMAGING MENTAL DISORDERS: THE PERSISTENCE OF INVOLUNTARY MEMORIES

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'Intrusive memories' are unwanted memories of stressful experiences that pop into mind involuntarily and cause distress. To better understand how a traumatic event may result in persistent, recurrent memories of that event we need to combine an experimental psychopathology approach with basic knowledge derived from cognitive neuroscience. Specifically, neuroimaging techniques such as functional Magnetic Resonance Imaging (fMRI) could help us capture the neural processes underlying the development of persistent trauma memory in humans; processes that are beyond behavioural or verbal expression.

Recent work from our group<sup>1,2</sup> and others<sup>3</sup> shows that brain activity during the encoding of stressful events (e.g. film footage with traumatic content/ classical fear conditioning) predicts long-term memory for the event, as measured by the frequency of subsequent intrusive memories of the event, or physiological fear responses to pictures that were previously paired with a shock. This suggests that involuntary memory is already (partially) formed during exposure to experimental trauma.

Findings like these open new avenues for studying the formation of emotional memory before it is expressed, and could offer insights into the processes that weaken and strengthen memory for salient events. In addition, these findings may even play a role in reducing 'stigma' associated with mental health problems, suggesting that even at the very time of processing an event, neural processing differences arise that will be associated with the development of psychopathology days and weeks later – analogous to say developing later physical symptoms after a physical injury. Research into the neural mechanisms involved in the development and maintenance of affective disorders seems at an exciting juncture for understanding symptomatology and could play an important role in treatment innovation as well as treatment selection<sup>4</sup>.

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<sup>1</sup> Clark, I. A., Niehaus, K. E., Duff, E. P., Di Simplicio, M. C., Clifford, G. D., Smith, S. M., ... & Holmes, E. A. (2014). First steps in using machine learning on fMRI data to predict intrusive memories of traumatic film footage. *Behaviour research and therapy*, 62, 37-46.

<sup>2</sup> Clark, I. A., Holmes, E. A., Woolrich, M. W., & Mackay, C. E. (2016). Intrusive memories to traumatic footage: the neural basis of their encoding and involuntary recall. *Psychological medicine*, 46(03), 505-518.

<sup>3</sup> Visser, R. M., Scholte, H. S., Beemsterboer, T., & Kindt, M. (2013). Neural pattern similarity predicts long-term fear memory. *Nature neuroscience*, 16(4), 388-390.

<sup>4</sup> Holmes, E. A., Craske, M. G., & Graybiel, A. M. (2014). A call for mental-health science. *Nature*, 511(7509), 287-289.

