Project Details	
Project Code	MRC21NMHEx Higginson
Title	Learning to be ill: the information ecology of mental illness
Research Theme	Neuroscience & Mental Health
Summary	The environmental causes of the onset and persistence of mental illnesses are not well understood. This project will develop a new approach that is founded in information ecology. We will develop computer models of learning and decision-making that capture the main features of depression, anxiety, PTSD, OCD, and related harmful behaviour.
Description	Mental illnesses are the primary cause of disability worldwide. Despite this, the causes of the onset and persistence of illnesses such as depression and anxiety disorder are not well understood. Medical approaches have tended to be based on the idea that mental illnesses are caused by pathological malfunction, but drugs are often ineffective. Other explanations involve theories about how disorders are appropriate responses to challenging environments, so they do not explain why illness persists when the environment improves. By using methods established in the behavioural sciences, Higginson has shown that whilst depression may not be an appropriate response to an individual's current environment, it could be a product of a cognitive system that learns about the environment but has incomplete information. This system could be a perfectly rational one in that it usually generates appropriate responses, even if it leads to bad outcomes for a minority of individuals. Of 10,000 individuals in a computer simulation that learnt about their world and decided when to invest costly effort, around 6% were inactive when it would be rewarding to be active, a defining symptom of depression. Whilst this work outlined the basic theory, it is only a first step. The student will develop computational models of behaviour to help understand and predict mental illnesses. The methodology will be probability theory and stochastic dynamic programming, borrowed from engineering and established in behavioural ecology, in which the student will be trained. This approach finds the optimal behaviour of an actor (e.g. whether to interact with the world) for various states of the actor (e.g. the probability that an interaction will be rewarding). In the first study, the existing depression model will be developed to assess how individual differences in the susceptibility to depression may arise from early life experiences. This will be based on the idea that in childhood the subconscious brain encodes beliefs about the environment, such as the likelihood of rewards. Another possible research direction would involve the characterisation of anxiety disorder as a consequence of a threat-detection system, that in some individuals cause deleterious beliefs and behaviour. The predictions of the models will be tested in online games to assess whether people behave as we expect. We have developed a basic version of the depression model currently under initial testing, and the student can develop this to match the theoretical models. With access to Wright's participants we could test whether behaviour in the game could be diagnostic of mental health issues. This project will address two research themes of MRC: mental health and wellbeing (theme 1) and lifestyles affecting health and environment

	and health (theme 2). Overall, the insights from this work could help to develop new interventions that help people living with mental illness.
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