Ruminating on the nature of intelligence: Personality predicts implicit theories and educational persistence

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ABSTRACT

Research in schools has shown that those who hold Incremental Theories of Intelligence (i.e. intelligence can grow and improve) generally outperform those who hold Entity Theories of Intelligence (i.e. intelligence is 'fixed' and cannot improve). Recently, there have been attempts to establish a stronger theoretical explanation for individual differences in educational success, by relating the Big Five's Conscientiousness to higher school attainment. In this study, we aimed to demonstrate further relationships between Implicit Theories of Intelligence and a well-known neurologically based theory of personality, namely Reinforcement Sensitivity Theory (RST). A sample of 319 adults completed personality measures of RST, the Big Five and Implicit Theories of Intelligence, as well as a proxy measure for educational persistence (highest academic qualification achieved). The results showed that participants who hold an Incremental (growth) Theory of Intelligence score higher on the RST Behavioural Approach System traits oriented toward future reward and the Big Five's Conscientiousness. Those that hold an Entity (fixed) Theory of Intelligence score higher on RST Behavioural Inhibition System and the Big Five Neuroticism measure. The paper discusses the implications of these relationships and explores the benefits of the simultaneous use of both theoretically underpinned and applied measures of individual differences.

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1. Introduction

Individuals' approaches to learning and their understanding of intelligence is highly varied. This variance can make the work of teachers and the education system difficult. Because of this, there have been efforts to develop measures that detect and predict individuals' beliefs regarding learning and intelligence. For example, Dweck (1999) developed measures of 'Implicit Theories of Intelligence'. Dweck reported that individuals' generally hold Incremental (intelligence can continually improve) or Entity (intelligence is fixed from birth) beliefs in intelligence. Implicit Theories have previously described individual differences in learning styles (such as Entity beliefs being related to avoiding challenges) but there has not been thorough research on the *source* of Implicit Theories. More recently, data driven trait models, such as the Big Five's Conscientiousness (organisation in thought and behaviour), have been used to predict educational success (Dumfart & Neubauer, 2016). This is important because personality traits have come to be considered behaviour 'generators' (Mõttus, 2016) and could be the 'source' of Implicit Theories. In this study, we test for a relationship between Big Five and

Implicit Theories measures and also ask if another popular, theoretically driven, personality theory (Reinforcement Sensitivity Theory [RST], see Corr, 2016) relates to Implicit Theories. RST is interesting as it has rarely been used to quantify applied behaviours, but it explains behaviour in approach and avoidance terms, much like the behaviours associated with Implicit Theories.

In education settings, research has demonstrated that academic performance and persistence are often related to an individual's belief about the malleability of their intelligence, referred to as Implicit Theories of Intelligence (Blackwell, Trzesniewski, & Dweck, 2007; De Castella & Byrne, 2015; Dweck, 1999; Renaud-Dubé, Guay, Talbot, Taylor, & Koestner, 2015; Robins & Pals, 2002). Dweck (1999) proposed that individuals tend to 'theorise' that intelligence is either an 'entity', in that it is fixed and unchanging, or that intelligence grows 'incrementally' and can be developed through effort and persistence in the face of challenge (typically, the former are referred to as 'entity theorists' and the latter as 'incremental theorists').

More recently, Implicit Theories of Intelligence have been used to explain malleability in social perception (Chiu, Hong, & Dweck, 1997; Hong, Chiu, Dweck, & Sacks, 1997) and business acumen (Kray & Haselhuhn, 2007). It is a robust finding that incremental theorists tend to outperform entity theorists (Chen & Pajares, 2010; Dupeyrat & Mariné, 2005; Rhodewalt, 1994). Further, interventions that train incremental theorising have been shown to benefit school children's

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attainment (Blackwell et al., 2007). The literature demonstrates that, typically, those that believe in growth, *do* grow and develop; and, thus, they show superior performance in a range of educational, work and social tasks (Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013). Research demonstrates that those with an entity theory tend to avoid difficult tasks since failure is a threatening outcome (punishment), rather than a learning opportunity with an eventual positive outcome of learning (reward). As Dweck and Leggett (1988) notes, the behavioural consequences of Implicit Theories are similar to 'approach' and 'avoidance' learning styles. In Huang's (2012) meta-analysis it was found (across 172 samples) that approach learning style was associated with higher academic achievement. As such, it could be the case that a better understanding of Implicit Theories in the context of individual differences approach and avoidance behaviours could help explain the relationship between Implicit Theories and academic behaviour.

The idea of individuals being divided based on their tendencies to engage (or approach) and disengage (or avoid) with opportunities for reward in their environment is not unique to implicit theory research. In fact, neuropsychology literature on personality differences in approach/avoidance behaviours explores the same phenomenon via 'Reinforcement Sensitivity Theory' (RST, for reviews see Corr, 2004; Leue & Beauducel, 2008). RST describes the processes by which an individual may show trait tendencies toward *approach* or *avoid* actions in relation to an aspect of one's environment. The three main systems of RST are the Behavioural Inhibition System (BIS, which inhibits approach to a potentially risky or punishing stimulus in the environment); the Behavioural Approach System (BAS, which drives a person to seek rewards from the environment); and the Flight-Fight-Freeze System (FFFS, which drives avoidance of aversive aspects of the environment). The various RST questionnaires have been tested in the psychological literature: in neuropsychology (Sutton & Davidson, 1997) and risk taking (such as; Voigt et al., 2009) research. However, RST has rarely been examined in applied settings. Specifically there is no thorough literature considering how RST may be manifest in an applied setting, such as a school.

We include also the Big Five theory of personality (McCrae & Costa, 1987) in our study. This theory of personality is the most frequently cited and used theory in personality psychology. It is important to note that Eysenck and Eysenck's (1978) work on Extraversion and Neuroticism is arguably the source of both the Big Five (see McCrae & John, 1992), as well as RST (see Corr, 2004). The Big Five is frequently used in contemporary education research, with Conscientiousness being a predictor of success (Dumfart & Neubauer, 2016; Zhang & Ziegler, 2016). Interestingly, recent research has shown that goal orientation (which features in both RST and Implicit Theories) mediates the influence of Conscientiousness at predicting success (Debicki, Kellermanns, Barnett, Pearson, & Pearson, 2016). Research has also shown that the Big Five can relate to education avoidance and achievement (Komarraju & Karau, 2005). It is also known that adults higher in Conscientiousness pursue higher levels of education (Almlund, Duckworth, Heckman, & Kautz, 2011). If we find that Conscientiousness correlates with goal directed RST traits (as has been shown elsewhere; Corr & Cooper, 2016) and Implicit Theories of Intelligence, it could be the case that BAS and Incremental Theories explain part of the variance in the pursuit of higher education. Thus we argue that the Big Five measure provides a psychometric and conceptual link between RST and Implicit Theories of Intelligence, making it worthy of inclusion here.

What is clear is that both measures - one theoretically underpinned and the other informed by application - are conceptually similar and could be related to the same neurologically-based phenomena that underpin learning and intelligence. The current study explores this notion. It may well be the case that the applied implicit theory measures share psychometric properties with the more theoretically underpinned and lab bound RST approach. Exploring these links could provide a theoretical and neuropsychological underpinning for Implicit Theories of

Intelligence and provide RST with an indication of its value in an applied setting (e.g. education), which is rare in current RST research.

We expect those with more Entity Theories of Intelligence to be more vulnerable to anxiety and more hesitant to act, for fear of failure (demonstrated by the RST BIS or Big Five Neuroticism). We would expect those with more Incremental Theories of Intelligence to be those who engage with more diligently and pursue higher levels of learning (demonstrated by the RST BAS, Big Five Conscientiousness and measures of educational persistence).

2. Method

2.1. Participants

Participants were recruited from the general population using online advertising distributed to volunteers who had signed up to UK University research databases, with encouraged snowball sampling. They received an automated summary of their personality traits in return for participation. Our sample ($N = 319$) had an average age of 31.16 years ($SD_{Age} = 11.27$; range 18–70 years of age; 8 participants withheld response), were predominantly female (79.20%) and most had achieved at least a bachelor's degree or equivalent (38.30% bachelors, 29.70% various postgraduate qualifications).

2.2. Procedure and materials

The study was conducted online, using Qualtrics online survey platform. After providing informed consent, participants reported their age, sex and highest level of educational attainment - highest level of education served as a proxy for academic persistence. We coded the highest level of education into four groups: engagement with pre-16 years old or *Mandatory Education*, such as 'GCSEs' (which we code as 1), engaged with post-16 or *Further Education*, such as 'A levels' (coded as 2), engaged with *Undergraduate* degree or equivalent (3) or pursued *Postgraduate* study, in masters, doctoral or equivalent (4).

The first personality measure completed by the participants was the RST-PQ (Corr & Cooper, 2016). The response format for the RST-PQ is a four point scale with the anchors being *Not at all* (1), *Slightly* (2), *Moderately* (3) and *Highly* (4). We computed the mean response to each of the RST-PQ traits to show average endorsement of the behaviours. The RST-PQ measures an individual's dispositional anxiety and rumination (BIS, 23 items, in our dataset the reliability of this factor was $\alpha = 0.93$), avoidance of aversive stimuli (FFFS, 10 items, $\alpha = 0.77$), tendency to respond aggressively (Defensive Fight, 8 items, $\alpha = 0.81$) and there are four subscales measuring the Behavioural Approach System (BAS): Reward Reactivity (tendency to spontaneous behaviour; 10 items, $\alpha = 0.77$); Impulsivity (fast and unplanned responding; 8 items, $\alpha = 0.70$); Goal-Drive Persistence (persistence in striving to achieve goals; 7 items, $\alpha = 0.85$); and Reward Interest (pursuit of potentially rewarding experiences; 7 items, $\alpha = 0.80$).

Second, participants completed the measures of Implicit Theories of Intelligence. We used two tools commonly in use: Dweck's (1999) four question for adult implicit theories of intelligence and Abd-El-Fattah and Yates' (2006) Implicit Theories of Intelligence Scale (ITIS). This scale has been shown to have adequate internal reliability. Participants responded to both of these measures using the recommended scale of *Strongly Disagree* (1), *Slightly Disagree* (2), *Slightly Agree* (3) and *Strongly Agree* (4). We averaged the responses to the questions on Dweck's scale to produce a value between 1 and 4 for each participant, where 4 is an endorsement of fixed theories of intelligence and 1 is a sign of a more growth theory of intelligence (in our dataset the reliability of this factor was $\alpha = 0.93$). Abd-El-Fattah and Yates' ITIS has two subscales, one measuring Entity Theories of Intelligence (7 items, $\alpha = 0.62$) and one measuring Incremental (7 items, $\alpha = 0.71$). Again we use the average score for all items in both of these subscales (where 4 is strongly agreeing with that sub-factor and 1 is strongly disagreeing). We also use this