Relational Frame Theory: A framework for psychologists to develop positive interventions to bring about real change in applied settings

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Behavioural psychologists aim to bring about positive change based on small numbers of scientifically sound and empirically tested concepts. Indeed, Skinner (1987) asked why are we not using behavioural psychology to save the world? That might sound a bit grandiose, but I think the underlying sentiment behind what Skinner was saying rings true, how can we use psychological science to create better environments for people to thrive? Before we move on, it is worth noting that there is often a misconception in textbooks and undergraduate psychology lectures that behavioural psychology is not interested in the mind or cognition. This is not true, for as Skinner (1974) wrote, "What is inside the skin, and how do we know about it? The answer is, I believe, the heart of radical behaviourism". Furthermore, going back to Alfred Binet in Paris in 1905 and the development of the first intelligence test and forerunner of the Stanford-Binet scales still widely used in assessment settings; his remit was to develop a test that could identify those children who needed extra help at school and were at risk of dropping out of the education system at a very young age. Thus, one of the foundational aims of psychology has always been to find scientific ways to help children in schools and increase cognitive aptitude or academic skill so that they remain in the education system for longer, which subsequently enhances their prospects later in life.

This backdrop provides some inspiration for a particularly promising online intervention for enhancing cognition and academic aptitude based on one particular behavioural theory of language and cognition, Relational Frame Theory (RFT; Hayes et al., 2001). At its core, RFT proposes that our derived relational responding, which is the process of discriminating and deriving relationships between stimuli, in accordance with particular relational frames, is fundamental to the development of language and cognition. As McLoughlin et al. (2020a) explained, when relations between arbitrary stimuli A:B and B:C (e.g., A is more than B, B is more than C) are directly trained or established, people will readily *derive* novel relations among stimulus combinations. Thus, in this particular example, people may derive $B<A$, $C<B$, $A>C$, and $C<A$ relations in the absence of any direct training or corrective feedback. To illustrate this core point more clearly, Colbert et al. (2018) provided a simple example of derived relational responding (i.e., relational framing), in that if a child is taught that a dog is larger than a cat and that a cat is larger than a mouse, the child is able to derive the relations between the animals in this network that have not been explicitly trained (i.e., a dog is larger than a mouse and a mouse is smaller than a dog).

In a conceptual paper, Cassidy et al. (2010) outlined their thesis that RFT uncovered the crucial building blocks that underpin what society might regard as intelligent behaviour. Put simply, it is based on the premise that behaviours that are considered ‘intelligent’ are instances of derived relational responding, or relational frames (e.g., same, opposite, different, more than/less than, here-there, now-then, etc.), and this behaviour is shaped in interactions with the environment, primarily by parents and caregivers initially. Standardised intelligence tests (e.g., Wechsler Scales such as WISC and WAIS) and tests of cognitive ability or aptitude are quite similar in that items generally require participants to observe or derive relations among stimuli (e.g., given a set of matrix images, choose the appropriate one to complete a particular sequence or pattern; Black is to White as Night is to ’blank’; see Cassidy et al., 2010).

A key idea is that derived relational responding is viewed as a generalised operant (i.e., learned behaviour) in RFT (but note that it is not accepted as such by all behaviour analytic psychologists). It should be acknowledged that RFT’s position that relational reasoning is a core feature of cognition, is also largely consistent (see McLoughlin et al., 2020a, for a thorough overview) with some recent developments and perspectives in education (e.g., Alexander, 2019; Goldwater & Schalk, 2016), linguistics (Everaert et al., 2015; Goldwater, 2017), and cognitive psychology (Goldwater et al., 2018).

An online programme based on RFT, Strengthening Mental Abilities with Relational Training (SMART) was established to enhance cognitive ability (Cassidy et al., 2016). It is a gamified programme, that trains the ability to relate stimuli, or in other words, domain general reasoning (May et al., 2022). Just a small subset of possible relational frames (Same/Opposite; More than/Less than) are trained using arbitrary nonsense syllables over a series of 55 stages of increasing difficulty in the programme. Critically, the programme employs new nonsense stimuli across every trial to ensure that it is the patterns of relational behaviour that are trained, and that these will apply across stimulus sets as long as the relevant contextual cue is present (McLoughlin et al., 2020a). It is an important feature of the programme that it does not use any material or stimuli that appear in school or university tests. Thus, SMART aims to establish “a generalised relational reasoning skill that can be applied to any educational domain or subject matter” (May et al., 2022).

To date there are a number of small-scale intervention trials in schools using the SMART programme. For example, in the first study in this domain, Cassidy et al. (2011) reported that engaging in relational training increased scores on the WISC, on average, by more than one standard deviation (i.e., 15 points). Given that the most championed cognitive interventions for raising intelligence using working memory training using the N-Back procedure typically achieve increases of just 2-3 points on standardised IQ tests (Au et al., 2015), such initial results appear remarkable. This initial finding was followed up by further studies in secondary schools that also reported large rises (using the Wechsler Abbreviated Scales of Intelligence, WASI) in IQ scores on standardised tests (e.g., Colbert et al., 2018) in adolescents exposed to SMART training over a period of 12 weeks, but not passive control groups.

However, these first set of studies using SMART did not use active control groups, but more recent studies have done so (e.g., Hayes & Stewart, 2016). For example, in McLoughlin et al. (2020b) we found a rise of 6 points on non-verbal component of the Kaufmann Brief Intelligence Test (K-BIT-2) for a group of 12-14-year-old secondary school pupils in the SMART group (n=43) versus less than 2 points increase in the Scratch Computer Coding control group (n=27), over a period of 3 months with just a mean stage completion percentage of approximately 16 out of the recommended 55 stages of SMART. In a trial with the youngest sample to date, McLoughlin et al. (2021), we tested a SMART group (n=30; again, with a mean training completion of just 15 stages) versus an online Chess programme control group (n=19) with primary school children (Mean age = 8.67 years). The primary school had purchased the online Chess programme as a tool that supposedly enhanced cognitive aptitude. Similarly to McLoughlin et al. (2020b), we found that the control group IQs remained about the same at post-test, while those who did SMART gained almost 9 points in non-verbal or fluid IQ. Interestingly, there was some evidence of far-transfer to performance on national curriculum standardised reading tests for the SMART group only, which is exciting as far transfer from cognitive training to educational domains is notoriously challenging to demonstrate (Sala & Gobet, 2019). Thus, the data seem very promising, given how difficult it has been historically to raise intelligence, IQ, or cognitive ability scores with generally null to minimal effects in many heavily promoted intervention methods such as chess (Sala & Gobet, 2016; 2017a), music (Sala & Gobet, 2017b), video games (Sala et al., 2018), and working memory training (Melby-Lervag & Hulme, 2013, 2016; Sala & Gobet, 2017c).

In a systematic review and meta-analysis of the SMART programme (see May et al., 2022) just published in the *British Journal of Educational Technology*, that included only studies with control groups, we found a moderate effect size for SMART (g = 0.57) on non-verbal IQ. While we remain cautiously optimistic about the merits and premise of the SMART programme, we called for larger, more rigorous randomised controlled trials to be conducted to more adequately assess the efficacy of the programme. We are aware that such large scale RCT studies are currently underway in Ghent in Belgium. Excitingly, SMART (and indeed any relational frame training programme), does not have to be limited to just school or educational settings. A clinical trial to test the potential for the SMART programme to positively influence cognitive decline in patients with multiple sclerosis in Nottingham and Lincoln has received approval. Trials using SMART with patients with Alzheimer's disease are ongoing in Sicily in Italy.

Thus, we are only at the tip of the iceberg in terms of potential application and development of this work, particularly as SMART only trains two relational frames and many others (e.g., here-there; now-then; I-You; hierarchy) could be established with different programmes, and the possible benefits for many applied contexts and populations remain to be examined. For applied psychologists, the promise of this line of work, underpinned by a solid theoretical foundation, is to engage in not just assessment alone, but also develop positive evidence-based environmental interventions with their clients to help create better futures.

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