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ABILITIES

Individual Differences in Self-Regulatory Abilities and their Role in Worldviews

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Abstract

Nowadays individuals find themselves living in increasingly multifaceted and diverse societies with varying capabilities to deal with them. Investigating individual differences in cognition and their relationship with beliefs and behaviours, may shed light on how different people navigate such diversity. This thesis aims to do this by providing evidence for the importance of investigating individual differences in cognition, and by contributing towards the theorisation and empirical study of the social-cognitive mechanisms of generalised beliefs, referred to as worldviews (Sammut, 2019; Sammut et al., 2022). Worldviews encompass beliefs that shape one's outlook on life and can be classified into five unique types, namely; *Localised*, *Orthodox*, *Pragmatist*, *Reward*, and *Survivor*. Three studies were carried out, the measures of which were all included in a two-part online data collection session. Study 1 provides evidence for a relationship between social values (Schwartz, 1992) and the five-factor typology of worldviews. Results showed that worldviews may be mapped onto two value dimensions; *Openness to Change versus Conservation*, and *Self-Transcendence versus Self-Enhancement*. Study 2 and Study 3 found that significant individual differences may be observed in self-regulatory abilities, within the context of worldviews. Particularly, there is evidence for a relationship between self-regulatory cognitive mechanisms, namely, inhibitory control (Study 2) and cognitive flexibility (Study 3), and worldviews. Inhibitory control was measured through one's performance in the Go/No-Go task, whereas cognitive flexibility was measured through one's performance in the Letter-Digit Classification task. Notably, the individual differences in Study 3 did not emerge from conventional analyses; they only became evident as a result of drift diffusion model analyses. Findings from Study 2 showed that individuals who were better at inhibitory control were more likely to endorse the *Orthodox* worldview, whereas findings from Study 3 showed that

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those who were better at cognitive flexibility were more likely to endorse the *Localised* or *Pragmatist* worldview. Overall, the findings of this inquiry supported the hypotheses that variations in cognitive processes give rise to divergent perceptions and experiences of the world. They also highlight the importance of shifting away from conventional data aggregation analyses to time-based modelling when investigating individual differences.

Keywords: individual differences, inhibitory control, cognitive flexibility, worldviews

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Publications**Chapter 3**

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Chapter 1

Introduction

In contrast to natural science, where theories can be easily generalised to the objects they apply to, psychology and cognitive science face the challenge of differences between people. Individuals undoubtedly vary in their cognitive abilities, yet many theories of cognition emerged out of an investigation on the average performance of a group of individuals (Hedge et al., 2018). For this reason, individual differences have largely been overlooked, hindering the understanding of the broader implications of such variations. More than 60 years ago, Cronbach (1957) described psychology as a discipline divided between two distinct approaches, experimental psychology and correlational psychology, each having its own “method, thought, and affiliation” (Cronbach, 1957, p. 671). On the one hand, the experimental approach aims to reduce variation and describe a cognitive mechanism that functions in the same way across individuals (Cronbach, 1957). It advocates precise control over variables in order to permit rigorous testing of hypotheses. On the other hand, the correlational approach, or the individual differences approach, is concerned with examining the factors that distinguish one individual from another (Cronbach, 1957). It has been decades since Cronbach’s (1957) paper yet his claim of a united approach of examining both within and between participant variance is far from being realised. Similarly to the discipline of psychology, much of cognitive science has followed the experimental approach, whilst purposefully avoiding the correlational approach (see, Hedge et al., 2018). As explained by Cronbach, “Individual differences have been an annoyance rather than a challenge to the experimenter. His goal is to control behaviour, and variation within treatments is

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proof that he has not succeeded” (Cronbach, 1957, p. 674). Given the struggle to minimise variation, individual differences have therefore been generally viewed as an inconvenience that disrupts the scientific study of human behaviour.

The running theme in this thesis is individual differences. It is important to note that “individual differences”, refers to those characteristics shaped by an individual’s genes and environment that contribute to a natural variation in cognitive ability or function (Carroll & Maxwell, 1979; Cronbach, 1957; Hunt et al., 1973). Consequently, more emphasis will be made on inter-individual variation, defined as the variability between individuals, as opposed to intra-individual variation, that is, differences that occur within an individual over a period of time or under different testing conditions (Cronbach, 1957). The explanation of regularities that hold across most neurotypical individuals is essential in establishing a theory of human behaviour, however, not understanding why different individuals display different behaviours results in an impoverished understanding. It is the recognition that individual differences are valuable to theory that make it an area worth studying. The importance of why individual differences in cognition deserve study may also be appreciated in more applied settings such as within educational (e.g., Barak & Levenberg, 2016; Lin et al., 2017) and clinical contexts (e.g., Constantino et al., 2017). For instance, Barak and Levenberg (2016) demonstrated that learners have different information processing habits. More precisely, they showed that learners with a better ability to think flexibly are more likely to thrive in a technology-enhanced environment. Likewise, findings on the role of attentional control suggest that those with a higher attentional control ability are likely to reap greater benefits from mindfulness-based training (Hölzel et al., 2011; Malinowski, 2013). From a theoretical perspective, theories such as the theory of Personality Systems Interactions (PSI) provide a framework for integrating individual disposition with cognitive

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processing (Kuhl & Baumann, 2021). Ultimately, acknowledging and understanding individual differences in cognitive abilities is important for strengthening our theoretical and practical understandings, that have to date mostly been based on a one-size-fits-all approach.

1.1 Individual Differences in Self-Regulatory Abilities

In recent years, studies have started to explore inter-individual variation in performances during cognitive and behavioural tasks (e.g., Buechner et al., 2020; Eisenberg et al., 2019; Ruiz et al., 2019; Zmigrod, et al., 2019a). Nonetheless, the reasons as to how and why these variations arise are still being uncovered. An area of cognition that may benefit from a theoretical and methodological revision through an individual differences investigation is self-regulation. Self-regulation entails self-awareness through the monitoring of thoughts, feelings, and behaviour, and is an undeniably important component in every individual (Nigg, 2017). It allows an individual to attain the ability to engage in goal-directed behaviour to bring about short-term and long-term desirable outcomes. Self-regulation is, therefore, an undeniably important mechanism for a well-functioning individual as well as society. In fact, poor self-regulation has been related to several psychopathologies, such as attention deficit/hyperactive disorder (ADHD) (e.g., Shiels & Hawk, 2010), addiction (e.g., Baumeister & Vonasch, 2015), and some personality disorders (e.g., Claes et al., 2009). Self-regulation has also been found to predict obesity (Teixeira et al., 2015), delinquency (e.g., Trentacosta & Shaw, 2009), and even homicide (e.g., Gillespie et al., 2018). Furthermore, within a developmental context it has been found to be essential for social and intellectual development, positively correlating with good health and academic success (e.g.,

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Montroy et al., 2016). For this reason, the need to assess individual differences in self-regulation within any of these contexts is critical.

1.1.1 Defining Self-Regulation

Self-regulation, as a construct, has generally lacked consistency, making it difficult to conceptualise. Self-regulation research has been overwhelmed by a number of models and theories, each occupying a different level and perspective of analysis in describing self-regulation. The most notable models and theories include goal systems theory (Kruglanski et al., 2002), the cybernetic model (Carver & Scheier, 1998), the strength model of self-regulation (Baumeister et al., 2018), and the dual-perspective model (Heatherton & Wagner, 2011; Hofmann et al., 2009), that has perhaps gained most popularity. Goal systems theory (Kruglanski et al., 2002) and the cybernetic model (Carver & Scheier, 1998) are two models that emphasise the importance of goals in self-regulation. Carver and Scheier (1998) suggest that self-regulation operates via a feedback loop or a conflict monitoring system that aims to reduce the discrepancy between a current state and a goal state. Similarly, Kruglanski et al. (2002) focus on the concept of goals, however, rather than feedback loops, this approach suggests that goals and their associated meanings make up a goal system in which the different associations drive behaviour. In contrast to these two models, the strength model of self-regulation ignores the importance of goals and rather focuses on the effort required to overcome undesired behaviour (Baumeister et al., 2018). This primarily makes it a model concerned with the limited resources required to exercise control, such that engaging in control with continued use depletes central resources available for subsequent control at a later time (Baumeister et al., 2018). In summary, these models address self-regulation from different perspectives, showing that it is a multi-faceted concept.

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1.1.2 A Dual-Systems Perspective

When it comes to the evolution of cognitive processing, the traditional line of thinking has been the metaphor of comparing the evolved human mind to a Swiss Army Knife (see Heyes, 2012). According to this metaphor, the human mind comprises a set of cognitive gadgets, each responsible for processing certain types of information or performing specific cognitive tasks. Despite garnering much interest, this hypothesis has also been subject to criticism due to lack of evidence for the existence of completely independent and domain-specific modules (e.g., the interaction between top-down and bottom-up processing) (Gibbs & Orden, 2010; Heyes, 2012). Acknowledging this is where I believe the importance of investigating individual differences in cognitive processes emerges. A dual systems approach to self-regulation is the theoretical framework used in this study. Models adopting this approach to self-regulation have largely emerged out of the seminal framework proposed by Norman and Shallice (1986). In this framework, schemas are utilised to guide the mapping of stimuli to their corresponding response. In the event that two or more schemas are co-activated, a contention scheduling mechanism is implemented to ensure that the most appropriate schema is utilised to carry out its stimulus-response mapping (Norman & Shallice, 1986). Contention scheduling is a lower-level mechanism that is typically activated in routine or habitual activities where executive functions are not required (Cooper & Shallice, 2000). Conversely, a higher-level cognitive mechanism is activated in novel activities: the supervisory attentional system (SAS) (Norman & Shallice, 1986). Notably, the SAS is responsible for troubleshooting in instances when routine and automatic processes are ineffective by imposing top-down goals that activate the appropriate schemas (Shallice & Burgess, 1993). For this reason, it is essential for the implementation and coordination of deliberate behaviour, making it a core requisite of executive functions (Norman &

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Shallice, 1986; Shallice & Burgess, 1993). In summary, contention scheduling is a conflict resolution system that requires few cognitive resources, whereas the SAS is an executive system that modulates top-down control by drawing upon a considerable number of cognitive resources. This conceptualisation is akin to the earlier work by Tversky and Kahneman (1974) which proposed a dual process model of thinking. According to the model, individuals use two types of systems to process information: System 1 and System 2. System 1 is the intuitive system that operates with little to no conscious effort. It is responsible for quick judgements and relies on heuristics (i.e., mental shortcuts) in order to process information quickly. Conversely, System 2 is the rational system that requires significant conscious effort and attention. This system is responsible for solving complex problems, engaging in critical thinking, and, notably, override biases that result out of System 1 (Kahneman & Tversky, 1974). Though targeting different cognitive activities, Norman and Shallice's (1986) SAS and Kahneman and Tversky's (1974) System 1 and System 2, both emphasise the existence of two distinct modes of thinking where one is automatic and intuitive (contention scheduling, system 1) and the other deliberate and effortful (SAS, system 2). Similarly to this, a bi-directional relationship between two general processes, bottom-up and top-down processes has also been suggested to underlie other cognitive activities, such as self-regulation (Eisenberg et al., 2019; Hofmann et al., 2009; Nigg, 2017). Research on bottom-up processes has primarily been concerned with spontaneous or reactive responses that can either be approach or avoidant and are highly influenced by the presence of an external stimulus (e.g., Carver, 2006; Phaf et al., 2014). Evidence suggests that that this impulsive system is related to activity in subcortical regions of the brain, namely, the ventral striatum, amygdala, and insula (Heatheron & Wagner, 2011). Indeed, these brain areas are typically associated with motivation and emotion, that have

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both been found to play a role in the cognitive control aspect of self-regulation (e.g., Chiew & Braver, 2011; Inzlicht et al., 2015). Particularly, this evidence suggests that motivation and emotion systems modulate control by reflexive reward valuation that serve short-term gratification (Chiew & Braver, 2011; Inzlicht et al., 2015). Research on top-down processes has been concerned with those cognitive processes, such as executive functions, that require working memory and have a limited capacity (e.g., Hagger et al., 2010; Hofmann et al., 2012). These processes act slower than bottom-up processes as they entail effortful and higher-order mental operations such as making deliberate judgements, setting long-term goals, and constructing optimal strategies (Hofmann et al., 2009). Crucially, they are important for overriding behavioural tendencies that arise out of the impulsive system. Such processes are mostly associated with the lateral prefrontal cortex, significantly setting them apart from bottom-up processes (Heatherton & Wagner, 2011). In summary, the dual-perspective model conceptualises self-regulation as the interplay between controlled and impulsive behaviours.

1.1.3 Top-Down Processes of Self-Regulation

From a neuroscientific perspective, self-regulation failure has been linked to lack of activity and/or malfunction in the prefrontal cortex (PFC), suggesting that top-down control from the PFC over subcortical regions plays a key role in self-regulation (e.g., Heatherton & Wagner, 2011). This has been further corroborated by findings showing that cognitive mechanisms characterised by persistent activity in the PFC, such as executive functions (Constantinidis et al., 2018), are critical for successful self-regulation (for review see, Nigg, 2017). Executive function comprises of three processes; working memory, inhibitory control, and cognitive flexibility or attentional set shifting ability (Miyake et al., 2000). Together they are responsible for resolving conflict, and planning

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and maintaining goal-directed behaviour (Miyake et al., 2000). Evidence suggests that working memory is associated with the dorsolateral prefrontal cortex (DLPFC) and is important for the maintenance and updating of relevant information, particularly by keeping information readily available (Baddeley, 2007; Miyake et al., 2000). Within the domain of self-regulation, working memory operations contribute to the ability to maintain active mental representations that are specific towards current or future goals (Hofmann et al., 2012). Furthermore, they are influential in guiding attention toward goal-relevant information and away from distracting or interfering stimuli (Hofmann et al., 2012). Inhibitory control refers to the ability to inhibit or overcome dominant, automatic and habitual responses (Miyake et al., 2000). Lastly, cognitive flexibility, also referred to as set-shifting or task-switching, refers to the ability to flexibly shift between multiple tasks or mental sets (Miyake et al., 2000). Its contribution to self-regulatory mechanisms entails the switching back and forth between different means that subserve the self-regulatory goal (Hofmann et al., 2012). These suggestions for a conceptual link, and evidence of a neuroanatomical association between executive function and self-regulation, underlines the promise of using measures of executive functions as a means to assess individual differences in top-down self-regulation. Indeed, in a review aimed at bridging the literature on executive functions from cognitive psychology and the literature on self-regulation in social and personality psychology, Hofmann et al. (2012) argue that executive functions are intrinsically involved in self-regulation in theoretically different ways, namely, as predictors, as process moderators, and as process mediators. Supporting this notion, Nigg (2017) also argued that executive functions occupy a central role in top-down self-regulation, suggesting that when executive functions are enabled during self-regulation, then executive function and self-regulation can essentially be considered the same. What is of particular relevance, is that measures of executive

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function contribute to self-regulatory outcomes. It is important to note that, as these different aspects of executive functions operate together, it is difficult to isolate the processes. Nevertheless, attempting to separately measure and investigate the contribution of each component may facilitate the understanding of the processes that are involved in effortful or top-down self-regulation.

In attempts to navigate the breadth that characterises the relationship between executive function and self-regulation, Nigg (2017) proposed two levels of categories, lower-level and higher-level processes. The former is conceptualised to include basic and early developing components of deliberate self-regulation, such as cognitive control and executive control, that support short-term goals (Nigg, 2017). Conversely, the latter is conceptualised to comprise of complex executive functions, such as planning and reasoning, that are implicated in long-term goals (Nigg, 2017). Therefore, these different levels of executive function, operate together to allow an individual to resolve immediate conflict as well as manage future conflicts or goals. Taken together this framework will be utilised to clearly define the specific processes that will be considered for the assessment of individual differences within the domain of self-regulation.

The Role of Inhibitory Control. An understanding shared by most conceptualisations of self-regulation is that it entails the effortful inhibition of responses or impulses that are incompatible with current or future goals (Miyake et al., 2000; Nigg, 2017). Therefore, a central aspect of self-regulation is inhibitory control (Nigg, 2017). Several findings have linked a lower ability in inhibitory control with poorer psychosocial outcomes due to its implication for self-regulation (e.g., Anzman-Frasca et al., 2015; McClelland & Cameron, 2011; Montroy et al., 2016; Rhoades et al., 2009). For instance, those demonstrating an inability to inhibit habitual responses (impulse-control

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deficiency) as measured by a Stroop-like task have been reported to exhibit poorer social competence and adjustment (Rhoades et al., 2009). Munakata et al. (2011) aimed at providing a unified framework of inhibitory control by distinguishing between two forms of inhibition – directed global inhibition versus indirect competitive inhibition. In line with the structural organisation of inhibitory control later suggested by Tiego et al. (2018), the former relates to response inhibition whereas the latter relates to attentional inhibition. These two forms of inhibition are proposed to be independent neurobiological mechanisms that both draw upon goal maintenance capabilities supported by working memory capacity (Munakata et al., 2011; Tiego et al., 2018). Response inhibition refers to the process of overcoming pre-potent motor responses, typically examined using non-selective stopping tasks in which individuals are intermittently required to suppress their motor response given a target stimulus (e.g., Go/No-Go tasks) (Hong et al., 2017; Tiego et al., 2018). Attentional inhibition refers to the ability to resist interference from distractors and has been typically assessed using visual matching tasks in which individuals are required to determine whether target and comparison stimuli are the same whilst ignoring distractors (e.g., Erikson Flanker Task) (Friedman & Miyake, 2004; Tiego et al., 2018). So, rather than inhibiting a response, this type of inhibition is characterised by the ability to attend only to goal-relevant stimuli (Friedman & Miyake, 2004). Inhibitory control has also been linked to decision-making ability (Munakata et al., 2011). Particularly, it is thought to be instrumental in weighing present and future benefits contributing to the ability of delay discounting, that is, being able to delay gratification and wait for larger rewards in the future (Munakata et al., 2011). Taken together, inhibitory control promotes better self-regulation and decision-making by facilitating the ability to control responses and ignore irrelevant distracting information.

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The Role of Cognitive Flexibility. The concept of cognitive flexibility broadly refers to the ability to adjust to changes in the environment by shifting between cognitive sets or mental strategies (Dajani & Uddin, 2015; Miyake & Friedman, 2012). It is a core component of self-regulation that enables adaptive functioning, having consequences within a variety of domains (Nigg, 2017). In contrast to the other executive functions, the relationship between cognitive flexibility and self-regulation has received little focus in the literature (see, Hofmann et al., 2012). A reason for this is because it has been described in various ways and lacks an agreed-upon operationalisation (Dajani & Uddin, 2015). For example, cognitive flexibility has been termed attentional switching or set-shifting within the context of attentional processes, and task-switching when operationalised by the tasks that assess it (see, Dajani & Uddin, 2015). Attentional shifting or set-shifting entails task paradigms in which participants are required to shift their visual spatial attention from one set of features to selectively attend to another set of features (Dajani & Uddin, 2015). Whereas task-switching entails task paradigms in which participants are required to alternate between tasks or switch between different sets of response rules as a result of varying task contingencies (Dajani & Uddin, 2015). Ultimately, both terms describe aspects of cognitive flexibility and mutually depend on inhibition and working memory ability (Dajani & Uddin, 2015; Miyake & Friedman, 2012). A number of propositions have been made as to how cognitive flexibility may facilitate self-regulation (e.g., Braem & Egner, 2018; Bridgett et al., 2013; Hofmann et al., 2012). Two salient arguments that have been made are that it allows for ‘means-shifting’ and ‘goal-shifting’ (Dajani & Uddin, 2015; Hofmann et al., 2012). ‘Means-shifting’ has been described as the ability to switch to alternative methods to reach the same goal (Hofmann et al., 2012). Conversely, ‘goal-shifting’, entails abandoning a self-regulatory goal in service of pursuing other alternatives (Dajani & Uddin, 2015).

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Therefore, in comparison to the role of other executive functions that tend to facilitate more rigid self-regulatory behaviour, cognitive flexibility contributes uniquely to self-regulation in that it promotes goal attainment in more fluid ways.

The Role of Working Memory. As noted in the aforementioned, working memory operations are important for goal representations as they facilitate the activation and maintenance of goal-relevant information (Diamond, 2013; Hofmann et al., 2011). Indeed, without an active representation of goals, self-regulation is rudderless, and individuals become more susceptible to self-regulation failure. For example, Hofmann et al. (2008) demonstrated that individual differences in working memory capacity have a modulating effect on the automatic versus controlled dispositions on self-regulatory behaviour. Particularly, findings suggested that the influence of automatic dispositions on self-regulatory behaviour negatively correlated with working memory capacity, such that individuals with a lower working memory capacity were more likely to rely on automatic processes (Hofmann et al., 2008). Research has also consistently provided evidence for the link between higher working memory capacity, better control of thoughts and behaviour, and improved response inhibition both in lab-based tasks and real-world outcomes, such as, within the domains of emotion regulation, eating behaviour, and sexual behaviour (e.g., Bridgett et al., 2013; Gunn & Finn, 2015; Hofmann et al., 2008; Schmeichel et al., 2008). Other than goal representation, another aspect that links working memory to self-regulation is attentional control. Executive attention is strongly implicated in self-regulation as goal-relevant influences and processing compete for the limited resource (Engle, 2018). Differences in working memory capacity have been found to reflect differences in the ability to maintain attention during goal-relevant tasks whilst avoiding or disengaging from attentional

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distractors (Engle, 2018). Particularly, individuals with a higher working memory capacity have demonstrated better performance during an anti-saccade task due to improved top-down control over their attention (Engle, 2002). Related to this, Hofmann et al. (2012) also propose executive attention is important to self-regulation because it plays a role in goal shielding. Goal shielding is defined as the process by which self-regulatory goals are protected against distractions and is thought to arise as a by-product of sustained attention towards a goal (Hofmann et al., 2012). Consequently, as individuals with high working memory would have better control over their attention, they would, therefore, also be more resistant to goals that compete with self-regulatory goals (Blair & Ursache, 2011; Hofmann et al., 2008). The various operations of working memory that have been outlined here provide evidence of the critical role that working memory occupies for successful self-regulation.

Evidence from Neuroscience. In order to successfully self-regulate it is essential for one to continuously monitor the context, trajectory, and outcome of actions (Ullsperger et al., 2014). The significance of this can be understood in terms of a feedback loop in which optimal cognitive, affective, and behavioural adaptations arise as a result of performance monitoring systems that detect deviations from the expected outcome (Ullsperger et al., 2014). Such feedback loops are implemented at various levels, however, in relation to the present study, the main focus will be on the monitoring of deliberate processes that involve the frontal cortex, as outlined previously. Indeed, in the framework proposed by Norman and Shallice (1986), performance monitoring is considered to be an important aspect of the SAS. Performance monitoring contributes to knowing when to implement cognitive control over established stimulus-response associations (i.e., schemas) and can be broken down into two aspects; reactive monitoring

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and proactive monitoring (Braver et al., 2008). The former is concerned with instances in which an error is detected after a response that results in an error (Ito et al., 2003). The detection of the error then serves as a basis for the regulation of control (Botvinick et al., 2001). Alternatively, proactive monitoring is concerned with instances in which a possible future error is inferred from the activation of a potential response (Aarts et al., 2008; Braver et al., 2008). Event-related potentials (ERP) that have been found to be related to performance monitoring and cognitive control (or in broad terms, self-regulation) include the error-related negativity (ERN), the N200, and the P300a (for review see, Ullsperger et al., 2014). The ERN and N200 are typically associated with reactive monitoring whereas, the P300a is typically associated with proactive monitoring (Grane et al., 2016; Ullsperger et al., 2014). Both the ERN and N200 are thought to reflect activity in the anterior cingulate cortex (ACC), a conflict monitoring system responsible for adjusting cognitive control (e.g., Dehaene et al., 2016; Holroyd & Yeung, 2012; van Veen & Carter, 2002). The ERN is characterised by a peak at around 50-100ms after a response is given and reflects the reactive error detection system (Gehring et al., 2012; Ullsperger et al., 2014). The N200 is an ERP component that is elicited during stimulus processing and is, therefore, an index of stimulus evaluation and response selection (Patel & Azzam, 2005; Ullsperger et al., 2014). Consequently, it is associated with the reactive monitoring system. In particular, the N200 is characterised by a peak at around 200-400ms after stimulus onset and a larger amplitude is thought to reflect higher conflict scenarios (Patel & Azzam, 2005; Ullsperger et al., 2014). Lastly, the P300s reflects activity in the frontocentral region and is associated with the attentional processes required to orient oneself to the oncoming stimulus. It is characterised by a positive peak at around 300ms after a cue has been presented (Grane et al., 2016; Ullsperger et al., 2014).

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1.1.4 Methodological Challenges: Executive Function and Individual Differences Research

The role of individual differences in cognition has often times been overlooked and this is particularly evident in the formulation of tools used to measure cognitive processes. Indeed, many of these tools and methods have been implemented to deliberately minimise inter-individual variations whilst maximising uniform behaviour and improving experimental reliability (see, Hedge et al., 2018). For instance, Hedge et al. (2018) have argued that individual differences cannot be investigated using traditional measures such as the Stroop task and the Posner-cueing task, amongst others. Even though these tasks have successfully been used in the context of individual differences (e.g., Prabhakaran et al., 2011; Susic-Vasic et al., 2012) as well as experimental contexts, the authors provide evidence that they are not entirely suitable for studying inter-individual variation as it goes against the premise by which they were built, that is, to produce generalisable findings. Undeniably, the difficulty of translating experimental effects to correlational research poses an often ignored and critical challenge. Likewise, a challenge that has prevailed amongst executive function research has been the reliability and validity of the measurement tools. A significant advancement in the study of executive function has been the attempts to identify and isolate its specific component processes (Miyake et al., 2000; Miyake & Friedman, 2012). As discussed earlier, processes that comprise executive function include working memory, inhibitory control, and cognitive flexibility or attentional set shifting ability (Miyake et al., 2000). Each of these processes is thought to be involved to some extent in situations that involve decision-making, error troubleshooting, the overcoming of habitual responses, and the need for novel behaviour. The inter-relatedness of these separate components highlights the so-called task impurity problem that has overwhelmed studies of executive functions

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(Burgess, 1997). In particular, this problem arises due to the known fact that any executive task implicates other cognitive processes that may not be directly relevant to the component process under study. For this reason, any measure or score achieved in an executive function task is not only comprised of the target component process but also a common component process (shared with others executive functions) and any non-related executive function processes. This, therefore, reduces both the reliability and validity of the measurement tool, and highlights the importance of acknowledging potential bias amongst the conclusions drawn by past and future research in this area.

1.2 Beliefs: A Worthy Domain of Inquiry

Truly understanding what beliefs are matters a great deal for knowing what it means to be human. Beliefs are central to every individual, they enrich our personal, social, political, and religious lives, they unite and divide us, and help us survive. The importance of beliefs in our lives is undeniable, however, getting to the root of what constitutes a belief has not been straight forward. Beliefs are vaguely characterised and have, therefore, been defined in different ways. Philosophers argue that beliefs are forms of “propositional attitudes” (Schwitzgebel, 2010). This implies that beliefs entail a mental state, most likely a certain attitude, towards a particular proposition. Similarly, from a psychological perspective, beliefs are thought, to a certain extent, form the basis of attitudes (Usó-Doménech & Nescolarde-Selva, 2016). Furthermore, they are also thought to entail a strong level of commitment reflecting both inner states and outer perceived realities (Usó-Doménech & Nescolarde-Selva, 2016). At the start of empirical investigations, psychological research tended to focus on the observable aspects of human behaviour (Hergenhahn & Henley, 2013). It was only within the last 20 years that beliefs started to garner attention. With developments in other domains of psychology,

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such as social psychology and cognitive psychology, beliefs have been further defined as a representation of the affective-cognitive structure of individuals, built upon acquired knowledge and emotional reactions towards various situations, with the end goal of providing a framework of action (Connors & Halligan, 2015; Tullett et al., 2013; Usó-Doménech & Nescolarde-Selva, 2016). Notably, from a social psychology perspective, beliefs differ from attitudes because unlike attitudes they do not necessarily contain an evaluative component (Kruglanski & Stroebe, 2005). Furthermore, from a cognitive perspective, beliefs differ from knowledge because they entail a larger self-referential element (Connors & Halligan, 2015). As opposed to knowledge, beliefs are also based on personal experiences and emotions, rather than objective fact (Connors & Halligan, 2015). Specifically, whereas knowledge concerns information that is verifiable and supported by evidence, beliefs concern information that is influenced by one's perspective, can exist without concrete evidence, and does not need to necessarily align with objective reality (Connors & Halligan, 2015; Jervis, 2006). Ultimately, the contribution of different domains gives the term "belief" multiple facets.

Salient to the current study is the investigation of whether possessing a particular set of beliefs affects self-regulation function and whether individual differences in self-regulation influence one's susceptibility to a particular belief system. Worldviews may be considered as a form of such belief systems. These are defined as representations of the structure of how and what people think and are proposed to operate in a way that allows one to adapt one's responses to the current ecological demands (Sammut, 2019; Sammut et al., 2022). This conceptualisation directly situates the notion of worldviews within the domain of self-regulation. Within the domain of cognitive science, belief systems have not been very popular objects of study (Porot & Mandelbaum, 2021). This may be partly due to the difficulty in measuring and evaluating belief systems, and partly

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because, unlike other modular psychological processes, beliefs are more distributed as they involve a number of other component processes (Connors & Halligan, 2015). Regarding the former, there is yet no complete cognitive account or consensus on what beliefs are, hindering an empirical investigation. Conversely, the latter concerns the issue that beliefs are a product of affective, perceptive, and higher-level cognitive processes (Harris et al., 2008) and therefore cannot be localised to one specific area in the brain, making them less tractable for study than lower-level cognitive process (such as attention, perception, and memory). This complex nature of beliefs has posed challenges for scientific investigation and, as a result, beliefs remain neglected by cognitive science. It would, therefore, be beneficial if an interdisciplinary approach in theory and methodology is taken towards the study of beliefs, shedding light on different facets of beliefs to expand understanding beyond a single domain. More precisely such an integrative approach can also help propel the exploration of beliefs within the discipline of cognitive science.

1.2.1 Elements of Belief Systems

In order to appreciate the significance of belief systems it is important to identify their constituents and respective functions. Usó-Doménech and Nescolarde-Selva (2016) distinguish between seven key elements that are required for belief systems: values, substantive beliefs, orientation, language, perspective, prescriptions and proscriptions, and ideological technology. Values are formulated on the basis of what an individual or social group deems to be important, desirable or favourable (Schwartz, 1992). Belief systems and values are linked to each other because the former allows the manifestation of the latter (Bond et al., 2004; Usó-Doménech & Nescolarde-Selva, 2016). Substantive beliefs relate to the actual content of the belief systems and shape the essence or core

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beliefs of that very belief system. Such beliefs include statements like *all people are equal, it is good to help others, God is real*. Orientation concerns the broader framework of assumptions that inform the beliefs whereas language is the logic that connects one substantive belief to another. Perspective provides meaning and identification by describing where the belief system stands in relation to the social environment. Prescriptions and proscriptions include the norms for behaviour and, lastly, ideological technology describes the means or strategy by which beliefs attain significance and justification (Nescolarde-Selva et al., 2017; Usó-Doménech & Nescolarde-Selva, 2016). All these elements, as proposed by Usó-Doménech and Nescolarde-Selva (2016), provide one of many explanations of how belief systems come about, are reinforced and expressed, and most importantly how they play a role in helping us make sense of ourselves and how the world works. Since values have been empirically shown to bridge the gap between individuals and society (Schwartz, 2012), and the present investigation entails individually and socially derived beliefs (worldviews), one focus of this study will be on the role of values.

1.2.2 Beliefs: A Personal-Social Matter

Up till now it is understood that beliefs and belief systems have several essential properties and features, namely: they vary in generalisability and strength, they may arise and be reinforced by experience, culture, society, philosophy, and theology, they are instrumental in helping us provide meaning of the world, ourselves and our place in society, and they also share a strong relationship with behaviour.

As stated earlier, a particular set of beliefs that we use to describe ourselves, and the world around us are, worldviews. Worldviews encompass beliefs that shape our outlook on life and they are pertinent in providing meaning to our reality and our

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understanding of how we fit within it (Koltko-Rivera, 2004). In an extensive review of the literature on worldviews, Koltko-Rivera (2004) has pointed out that the construct of worldviews has been defined and named in a multitude of different ways; from cultural and value orientations that aim at conceptualising worldviews at a social level (Hofstede, 1984; Schwartz, 2006; Schwartz, 1992), to the world-outlook and philosophy, aimed at conceptualising worldviews at an individual level (Maslow, 2012). More than a decade later, this scene on worldviews is still relatively the same and there is yet no unified understanding of it. For the purposes of this thesis, and similarly to the definition proposed by Koltko-Rivera (2004), worldviews will be defined as representations of the structure of how and what people think and are proposed to operate in a way that allows one to adapt one's responses to present ecological demands (Sammur, 2019; Sammur et al., 2022). As outlined by Sammur et al. (2022), within the domain of social science, a number of conceptualisations that fall in line with the present definition of worldviews have been identified, albeit, under different names. Namely, four theories that possess identical five factor typologies have been identified (Sammur et al., 2022). These are: symbolic universes (Salvatore et al., 2018), social axioms (Leung & Bond, 2009), moral foundations (Haidt, 2012), and deep stories (Hochschild, 2016). The following presents a summary of each, before following with an overview on the notion of worldviews proposed by Sammur et al. (2022).

Symbolic Universes. The notion of symbolic universes proposed by Salvatore et al. (2018) is fundamentally based on semiotic cultural psychological theory (SCPT). It is beyond the scope of this thesis to delve into the philosophies underlying SCPT (see, Salvatore et al., 2019 for detailed discussion), however, it is generally understood to be an integration of relational psychoanalysis, Dynamic Systems Theory, and pragmatic

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semiotics, modelling how one acquires meaning through cultural-level communication dynamics. In other words, it explains the interaction between the culturally embedded meanings and individual cognition. The term symbolic universes, therefore, refers to such generalised, affect-laden meanings that are embedded in culture and that individuals use as a vehicle to make sense of themselves and their relationship with the world around them (Salvatore et al., 2019; Salvatore et al., 2018). The five types of symbolic universes, identified by means of an analysis carried out on the Views of Context (VOC) questionnaire (Ciavolino et al., 2017), are: *Ordered Universe*, *Interpersonal Bond*, *Caring Society*, *Niche of Belongingness*, and *Others' World*.

Ordered Universe is characterised by the belief that the world possesses its own form of harmony, and one must follow the natural order of things to maintain this harmony. It describes a generalised positive view of the world and is based on the values of making the world a better place, rejecting power and opportunism. *Interpersonal Bond* is characterised by optimistic and positive attitudes towards the world. It centres around the core belief that interpersonal, emotional bonds are of utmost importance and essential components to derive meaning and fulfilment from the world. *Caring Society* is characterised by the belief that society and its institutions are trustworthy and successfully provide for the needs of people and this trust should be used as grounds for a sense of agency. Notably, however, this sense of agency should respect the boundaries put in place by society. *Niche of Belongingness* is similar to *Interpersonal Bond* with the exception that it is associated with a generally negative view of the world. Consequently, this type of symbolic universe is characterised by untrustworthiness and apathy towards social institutions and agencies, seeking solace and comfort from family or close friends (i.e., individuals who comprise the primary social network). Lastly, *Others' World* is the symbolic universe that is associated with the worst possible views of the world that one

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has absolutely no control of. A central characteristic of this worldview is the fatalistic approach to life's problems, a total surrender to those in power (Salvatore et al., 2018).

It is worth noting that SCPT emphasises the dynamic relationship between individual, social and cultural aspects of life. It is for this reason that Salvatore et al. (2018) claim that symbolic universes are unsuitable to describe individual psychological characteristics, but rather may be considered instrumental in explaining how past, present, and future socio-political scenarios tend to be addressed by people.

Moral Foundations. Moral foundations theory initially emerged out of the desire to understand cultural differences in moral thought and behaviour (Haidt & Joseph, 2004). In more recent years it has been applied to gain some understanding of the ever-growing political polarisation that the United States of America (USA) faces (Haidt, 2012). Moral foundations theory is strongly rooted in evolutionary psychology where the premise is that moral functioning is thought to primarily be based on intuitive judgements rather than thoughtful deliberations, unlike what is emphasised in the well-known morality research carried out by Kohlberg (1971) (Haidt & Joseph, 2004). The argument also follows that a strong minority of these moral intuitions are innate, primitive, and hard-wired in us, organised in a set way outside of the influence of experience (Haidt & Joseph, 2008). Furthermore, these moral intuitions are developed to varying degrees across societies and cultures resulting in different moral judgements (Graham et al., 2013). Indeed, Graham et al. (2013) perfectly capture the essence of Moral Foundations Theory by stating that it is ultimately “about the universal draft of the moral mind” (p.10), a sort of common moral template on which the rest of morality is developed. Another aspect that is closely connected to moral intuitions are virtues. The concept of virtues is very much related to that of values, and described as traits that are considered morally

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good and that allow one to act in the way that best approximates one's personal ideal (Haidt & Joseph, 2004). The term 'virtue' tends to be favoured over the term 'value' in moral research because of its greater emphasis on morality (Haidt & Joseph, 2004, 2008). Haidt and Joseph (2008) identified five moral foundations comprising of such virtues, moral intuitions, and consequently, the underlying template of morality. These are: *Harm/Care*, *Fairness/Reciprocity*, *Loyalty/Betrayal*, *Authority/Respect*, and *Purity/Sanctity* (Graham et al., 2013; Haidt & Joseph, 2008; Haidt, 2012).

The *Harm/Care* foundation arises out of the challenge of caring for vulnerable offspring and ensuring that offspring remain alive. The argument follows that being able to care for offspring is not something that is entirely learnt from culture and society but is importantly also an innate ability honed through evolution. Humans (and other mammals) have become attuned to the signals of suffering and distress in their offspring and, consequently, this triggers kindness and compassion. Consequently, this brings about a general tendency of condemning cruelty and aggression and valuing kindness and compassion. Nevertheless, this tendency is not universal, and it is possible that groups of individuals, cultures, and societies perceive the opposite, that is, cruelty and aggression as virtuous, and kindness and compassion as vices. The *Fairness/Reciprocity* foundation emerges out of the evolutionary advantage of cooperating and forming alliances with non-kin individuals, thus, valuing reciprocation and condemning cheating. This foundation strongly relates to the virtue of justice. The *Loyalty/Betrayal* foundation primarily evolved from kin relations and describes the tendency for humans to form groups (not necessarily being kin-based) that compete against one another. The strengthening of in-group cohesion calls upon the virtues of loyalty, self-sacrifice, and patriotism and condemns betrayal. The *Authority/Respect* foundation concerns the psychological and social aspects of dominance hierarchies. This foundation evolved out

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of the human ability to form hierarchical social structures and promotes the virtues of duty (for superiors) and obedience (for subordinates) to maintain such structure. Finally, the *Purity/Sanctity* foundation is shaped by the emotion and psychology of disgust. It relates to the notion that the emotion of disgust, that evolutionary functioned as a means of deterring humans from harmful pathogens, has morphed into a social emotion that generates virtues of temperance and chastity. In summary moral foundations, emerging from universal evolutionary-shaped intuitions, serve as building blocks from which the rest of morality is developed. Individual and cultural differences in moral judgements, therefore, arise due to variations in the extent at which each moral foundation is amplified or subdued (Graham et al., 2013; Haidt & Joseph, 2008; Haidt, 2012). It is worth noting that additional studies on moral foundations have mapped these five foundations onto two higher order foundations, with *Harm/Care* and *Fairness/Reciprocity* collapsed under the individualising foundation and *Loyalty/Betrayal*, *Authority/Respect*, and *Purity/Sanctity* collapsed under the binding foundations (Graham et al., 2011, 2013).

Social Axioms. The construct of social axioms is based on the psychological literature on beliefs and was initially conceptualised to offer an understanding on cultural differences that could not be solely explained by value theories such as that of Schwartz (1992) (Leung et al., 2002; Leung & Bond, 2009). Put simply, social axioms describe general beliefs about the social world, playing a significant role in providing guidelines for social interaction and problem-solving (Leung & Bond, 2009). The authors claim that the use of the term ‘social’ emphasises the notions that axioms are social experiences, whereas the term ‘axioms’ emphasises the nature of these beliefs in that they are endorsed without too much deliberation regarding their validity. Typically, these generalised beliefs comprise of an assertion regarding the relationship between two entities or

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concepts (Leung et al., 2002; Leung & Bond, 2009). This key characterisation of social axioms distinguishes them from values because, in contrast, values concern the importance of a single concept or entity (Leung et al., 2002; Leung & Bond, 2009). Despite this difference between social axioms and values, there is still an overlap between the two concepts. Value-expressiveness is proposed to be a central function, along with knowledge, instrumentality, and ego-defensiveness, that social axioms serve. Value-expressiveness refers to the role that social axioms play in shaping values as well as translating them into congruent actionable behaviour. Knowledge describes the concept that social axioms serve as general knowledge about the world and facilitate comprehension and navigation of such a world. Instrumentality refers to the function that social axioms facilitate attainment of goals by serving as guiding principles by which the best behaviour corresponding to goal attainment is selected (Leung et al., 2002). Lastly, ego-defensiveness highlights the implications of social axioms on self-worth and subjective well-being. Since social axioms guide behaviour, they may also be telling of how an individual copes with life's challenges (Leung et al., 2002). Following these functions of social axioms, Leung et al. (2002) proposed a five-factor typology of social axioms. These five factors were identified through an exploratory factor analysis carried out on data gathered through literature reviews on beliefs, interviews, and content analysis of cultural products (e.g., the media) and includes *Social Cynicism*, *Social Complexity*, *Reward for Application*, *Religiosity*, and *Fate Control* (Leung et al., 2002; Leung & Bond, 2009).

Social Cynicism asserts a negative view of humankind and the world in general, expressing distrust towards social institutions and those in authority (Leung & Bond, 2009). Leung and Bond (2004) claim that individuals high in social cynicism are predisposed towards acting selfishly with little regard towards others. *Reward for*

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Application refers to human agency relating to both the self as well as others (Leung & Bond, 2009). Essentially, it refers to the belief that hard work leads to positive outcomes and has been found to be linked to prosocial and pro relationship values and behaviours (Bond et al., 2004). *Social Complexity* fosters problem solving, and for this reason, asserts the belief that there are multiple ways to achieve a goal or solve a problem. Furthermore, it views human behaviours as inconsistent and difficult to predict due to the need for adapting behaviour to varying circumstances (Leung & Bond, 2009). *Fate Control* is the belief life events are pre-determined by external forces such as fate and luck, but one can acquire some degree of control in one way or another (Bond et al., 2004; Leung & Bond, 2009). Notably, *Fate Control* is to be distinguished from *Religiosity*, the fifth and last factor, that refers to a belief in the existence of a supreme being. *Religiosity* asserts that religious beliefs and religious institutions are beneficial for human social life (Leung & Bond, 2009). In summary, these dimensions form a system of context-free pan-cultural beliefs demonstrating solid empirical evidence for predicting outcomes for individuals and wider social groups (Leung & Bond, 2004).

Deep Stories. The notion of deep stories was conceptualised to address and facilitate understanding of right-wing politics in the USA (Hochschild, 2016). In her study, Hochschild (2016) combined a number of in-depth qualitative and ethnographic research methods to build a narrative that sheds light on the rise of the Tea Party and Donald Trump supporters. It is beyond the scope of the present study to go into the detail of the deep stories relating to the conservative-minded individuals residing in southern states, but rather, what is of interest is the concept of deep stories itself because it appears to describe one's socio-political worldview. Particularly, it poses a novel way of uncovering deep-felt emotions, and attitudes in general, surrounding social and political

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matters (Hochschild, 2016). A deep story is essentially a metaphor conveying a “deep” subjective interpretation of the world and one’s position within it. Within the deep stories that emerged out of her study, Hochschild (2016) extracted four primary profiles: the *Team Player*, *Worshipper*, *Cowboy*, and *Rebel*.

The *Team Player* prioritises loyalty to their community or social group (e.g., family, religion) over anything else. Such individuals are prepared to endure any harm caused by one’s own community or social group, as for them, loyalty is worthwhile for the success of their group and ultimately outweighs any felt consequences. The *Worshipper* endures hardships by finding refuge in their faith towards God. Their approach towards life entails renouncing themselves and their own desires and leaving matters in the hands of God, hoping that everything sorts itself out eventually. The *Cowboy* flourishes in danger and is prone to risk-taking. Any harm that is experienced is seen as a badge of honour that shows off their bravery, strong moral character, and affirms their fearless self. Lastly, is the *Rebel*, typically defined as a team loyalist with a new cause. Such individuals challenge the status quo and actively work towards, and promote, social and political change. The *Rebel* still maintains loyalty to their group despite their activism that opposes their group’s cause. Notably, the *Team Player*, *Worshipper*, and *Cowboy* are willing to suffer and make sacrifices for the benefits of capitalism, an aspect that distinguishes the *Rebel* apart from these profiles. A fifth profile, that is not as explicitly mentioned along with these four profiles is the *Cosmopolitan*. The *Cosmopolitan* describes an individual who is loosely attached to a particular community and is prepared to know a lot of people, but to a limited extent. Such an individual takes pride in exposing themselves to a variety of moral codes and flexibly adapts to different social and cultural contexts. Particularly, the *Cosmopolitan* profile contrasts the *Team Player*, *Worshipper*, and *Cowboy*, which largely describe an individual who is connected

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to their local community, patiently endure hardship, and generally endorse a conservative worldview. All these profiles emerge as a product of the intersection between emotional self-interest and cultural and socio-political influences. Consequently, they pose as an alternative way of categorising individuals' worldviews (Hochschild, 2016).

Worldviews. It is worth noting that the above concepts and typologies possess a couple of common features. Firstly, they are not solely focusing on individual disposition but more importantly they are situating individual disposition within the wider social sphere, tapping into the psychological constructs that shape the way individuals interpret their social world. Secondly, they all serve a practical purpose enabling individuals to adapt suitably to different situational demands. For instance, the symbolic universe, *Interpersonal Bond*; the moral foundation, *Loyalty/Betrayal*; and the deep story profile, *Team Player*, emphasise pro social behaviour. Conversely, the symbolic universe, *Others' World*; the social axiom, *Social Cynicism*; the moral foundation, *Authority/Respect*; and the deep story profile, *Cowboy*, emphasise selfish behaviour. With consideration to these common features, Sammut et al. (2019; 2022) proposed the notion of worldviews, offering a novel five-factor typology aimed at unifying the above-mentioned concepts. The five worldview types include the *Localised*, *Orthodox*, *Pragmatist*, *Reward*, and *Survivor* worldviews (Sammut, 2019; Sammut et al., 2022). The *Localised* worldview involves the desire to fix problems or address social issues. The *Orthodox* worldview seeks to preserve the status quo. The *Pragmatist* worldview is protective and revolves around self-interest. The *Reward* worldview centres around determination to work hard to obtain a desired goal. Lastly, the *Survivor* worldview involves fatalism and distrust in others (Sammut, 2019; Sammut et al., 2022). A more in-

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depth review on the concept of worldviews as well as the main aspect that differentiates worldviews from the aforementioned typologies will be provided in Chapter 4.

1.3 Objectives and Overview

This chapter has provided a review of the existing body of research on individual differences in self-regulatory abilities, and the conceptualisation of worldview-related typologies. The synthesis of social and cultural theory with cognitive science perspectives offers a deeper understanding of how cognitive processing is not a discreet modular entity but rather interacts with various factors, such as one's beliefs. Overall, this thesis has two primary objectives: 1) to provide evidence for the importance of investigating individual differences in cognitive processing, and 2) to contribute to the theorisation and empirical study of social-cognitive mechanisms of worldviews. Regarding the first objective, the aim is to show how specific cognitive processes manifest differently between individuals. Moreover, the aim is also to demonstrate the importance of shifting from conventional analyses, that aggregates data from multiple time points, to more intricate analyses (hierarchical drift diffusion modelling), that model data across time, to effectively capture individual differences. Regarding the second objective, the aim is to adopt a nuanced approach of bridging cognitive science with social psychology and cultural theory to uncover some of the cognitive factors that influence how worldviews are shaped and how they are reflected in behaviour. Chapters 3-5 constitute empirical investigations of the interplay between worldviews, values, and self-regulatory abilities (inhibitory control and cognitive flexibility), leading to an overarching discussion of the amalgamated findings in Chapter 6. However, before exploring these studies, the next chapter (Chapter 2) provides an overview of the methodology, aims, and objectives that concern each study of this thesis.

Chapter 2

Overview of Studies

The central focus of this thesis is the investigation of individual differences in self-regulatory cognitive processes. Before delving into the studies behind this investigation, it is worth acknowledging some notable methodological characteristics of individual differences research that have informed the design of the studies of this thesis. One key characteristic is that individual differences research is known to entail the investigation of the covariation amongst multiple variables. In Studies 1-3 (Chapters 3-5) of this thesis, as is typical of individual differences research, such variables fell into three distinct categories: a) demographic variables that are easy to measure (e.g., age, gender); b) variables measured through psychometric instruments (e.g., personality, values); and c) variables measured through performance on experimental tasks (e.g., memory, attention) (see Rouder & Haaf, 2019). Another common characteristic of individual differences research is that the same group of participants encounter the same measures and conditions, thus, reducing the confounding influences that may arise from other individual differences beyond those under investigation (e.g., Eisenberg et al., 2019; Gärtner & Strobel, 2021; Zmigrod et al., 2021). Moreover, this method proves to be efficient since it reduces the need to recruit and manage a large number of different participants. This is particularly valuable in individual differences research because it often requires a substantial sample size to achieve sufficient statistical power. Taking this into consideration, a two-part data collection session was carried out, using the same group of participants, and encompassing all the measures from Studies 1-3. The following outlines each of the studies' objective before outlining the common features of the methodology behind these studies.

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2.1 Objectives

Study 1 (Chapter 3) explores the relationship between worldviews and values. Despite relating to different frameworks, there is a degree of overlap between these two constructs that I believe is worthy of investigation. As I discuss in the following Chapter (Chapter 3), worldviews and values may be thought of as comprising a hierarchical structure with values being the more abstract and worldviews being the less abstract (Homer & Kahle, 1988). Some meaningful relationships have already been uncovered between values and other belief constructs, such as moral foundations and social axioms. In Study 1 I show that such relationships can also be extended to worldviews. Particularly, by identifying categorical similarities and differences (in terms of these values) between worldviews, the findings of this study provide a basis for the later investigations of the cognitive correlates of worldviews that follows in Study 2 (Chapter 4) and Study 3 (Chapter 5).

Study 2 (Chapter 4) explores the relationship between inhibitory control and worldviews. This is an important study because it marks the first attempt to associate cognitive ability to worldviews. The motivation behind this study is the notion that the concept of worldviews, which are thought to be responsible for helping us adapt to changes to the world around us, shares a link with the concept of self-regulation. In Study 2, I show that there is considerable existing literature that supports this link, especially in relation to inhibitory control. Inhibitory control describes the ability to suppress automatic or habitual responses in favour of a more goal-directed response (Friedman & Miyake, 2004). Studies investigating individual differences in inhibitory control have largely done so from a political science perspective (e.g., Amodio et al., 2007; Buechner et al., 2020). Nonetheless, I argue that findings that emerged from such studies demonstrate the potential of discovering similar links between inhibitory control and

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worldviews. Study 2 adds to the body of research investigating individual differences in inhibitory control in terms of beliefs or ideology, and it does so by utilising an objective measure of inhibitory control.

Study 3 (Chapter 5) explores the relationship between cognitive flexibility and worldviews. The purpose of this study is to build upon the findings of the first and second studies by exploring other cognitive avenues which may be linked to possible differences between worldviews. Cognitive flexibility broadly refers to the ability to adjust to changes in the environment by shifting between cognitive sets or mental strategies (Dajani & Uddin, 2015; Miyake & Friedman, 2012) and, like inhibitory control, is thought to be linked to self-regulation (Nigg, 2017). In a similar manner to Study 2, I argue that findings that emerged from studies on political beliefs or ideologies demonstrate the potential for discovering similar links between cognitive flexibility and worldviews. Notably, in this study I utilise drift diffusion model (DDM) analyses to investigate this link. DDM models the decision-making process implicated during speeded two-choice decision tasks. It is more nuanced than conventional analyses because it does not aggregate data but rather utilises a sequential sampling approach to model data across time. Along with Study 2, Study 3 provides further evidence that differences in cognitive processes may predispose certain individuals to particular worldviews over others.

2.2 Method

2.2.1 Sample

Participants were recruited through Prolific Academic (ProA). ProA has been reported to produce superior data quality for behavioural research when compared to other online recruitment platforms such as Amazon's Mechanical Turk (MTurk) (Peer et

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al., 2017). Since participation was required in two different sessions, participants were pre-screened in ProA using the criteria of having already taken part in a minimum of five other studies and possessing an approval rate of 100%. These criteria were selected to ensure that participants had prior experience with using ProA and taking part in online studies. An additional criterion consisted of having a minimum age of 18 and a maximum age of 30. In a study investigating the developmental trajectories of executive function, Ferguson et al. (2021) reported that inhibitory control shows a decline from 35 years of age and working memory capacity shows a decline from 30 years of age. The age criterion was included to avoid the overall confounding influence of age-related effects in the studies 2 and 3 discussed in Chapters 4 and 5 respectively.

An initial total of 290 participants were recruited, 33 of which failed the attention checks put in place to ensure good quality of the data, and 6 participants failed to participate in the second session, resulting in 251 participants. For statistical analyses used to detect group differences, a medium to large effect size (see, Cohen, 1988) can be achieved with a sample size ranging from 20-60 participants per sub-group. Furthermore, for regression analysis, Green (1991) recommends the rule of thumb of $N \geq 50 + 8m$ (resulting in a minimum of 90 participants, where m , the number of predictor variables, represents the 5 different types of worldviews). To further increase the statistical power, Brysbaert (2019) also recommends to raise the number of observation per participant per condition. This approach was taken in Study 2 and Study 3 as outlined in sections 4.4. and 5.3 respectively. Taking this into consideration along with the distribution of worldviews reported in other studies (see Sammut et al., 2022), the resulting sample size was deemed adequate to proceed with analysis. Out of the 251 participants ($M_{age} = 25.12$, $SD_{age} = 3.20$), 156 identified as female and 95 identified as male. All participants resided in one of the OECD countries as per ProA's sign-up criterion. Most participants resided

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in Europe (66.9%), followed by Africa (17.9%), America and Canada (8.4%), and lastly Australia (6.0%).

2.2.2 Measures

While all three studies incorporated the measure of worldviews, each study had additional distinct measures of interest. Study 1 (Chapter 3) was concerned with the measure of values (PVQ-RR)(Schwartz, 2012). Study 2 (Chapter 4) was concerned with the measures of inhibitory control (Go/No-Go task) and working memory (Operation Span task). Finally, Study 3 (Chapter 5) was concerned with the measures of cognitive flexibility (Letter-Digit Classification task) and working memory (Operation Span task). Detailed information pertaining to each specific measure is provided within the respective chapter. As for the measure of worldviews, since it was applied to all studies, it is discussed in the following section.

Worldviews. The worldview measure is the same as the one created and used by Sammut et al (2022) (see, Appendix B.1). As shown in Table 1, this measure comprises a list of 5 vignettes, each characterising one of the worldviews. For each of these vignettes, participants were asked to rate the extent to which they believed that each applied to themselves using a Likert scale ranging from 1 (not at all) to 5 (completely) (continuous measures). In addition, participants were also required to select a single vignette that best approximated their own views (categorical measure). When asked to select the single worldview that best approximated their own, the majority chose the *Localised* worldview (45.4%), followed by *Pragmatist* (24.7%), *Reward* (13.1%), *Orthodox* (8.8%), and lastly, *Survivor* (8.0%). When asked to rate the extent of their agreement with each individual worldview, the *Localised* worldview received the highest

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rating ($M = 4.08$, $SD = .79$) whereas the *Survivor* worldview received the lowest rating ($M = 2.60$, $SD = 1.17$).

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Table 1*Worldview Measures*

Worldview	Vignette
<i>Localised</i>	<p>The future depends on us and the choices we make.</p> <p>Every problem has a solution. Each and every one of us can make an effort to fix the laws and institutions so that they can be just and equal for everyone. Like this we can better address the needs of people and society.</p>
<i>Orthodox</i>	<p>To succeed in life, we need to follow the rules and local customs in order to maintain social order. We also need to show respect to each other and carry out our duties.</p> <p>Like this we can help others in our community.</p>
<i>Pragmatist</i>	<p>In life we must adapt ourselves to our circumstances and sometimes we need to go with the flow in order to avoid trouble. The rich and powerful protect their own interests, whereas the kind-hearted suffer. Sometimes you have to work around the rules to help your loved ones.</p>
<i>Reward</i>	<p>In life, you get what you deserve. Life's challenges are overcome with the efforts we make, and these may offer new opportunities. One must co-operate with others, respect authority, and carry out one's duties. Our efforts will eventually lead to success.</p>
<i>Survivor</i>	<p>In life, things rarely end up well. People are what they are, and good people usually suffer and are exploited. It is best for one to keep his/her head down and get on with it.</p>

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2.2.3 Procedure

Individuals registered on Prolific and who satisfied the recruitment criteria (see Section 3.2.1 above) were sent an invitation to participate in the study. Participants were provided with an information letter and consent form (Appendix A) outlining the details of the study, notably being informed that their participation would be required in two separate sessions. The purpose of conducting two separate sessions was to prevent the risk of fatigue. Following consent of participation by clicking the “continue to experiment” button, the first session commenced. This session comprised of the Go/No-Go task, the Letter-Digit Classification task, and a questionnaire divided into three sections. The first section consisted of a scale measuring perceived locus of control (Duttweiler, 1984), the second consisted of the worldview vignettes and scale, and the third consisted of a measure of the personality factors of conscientiousness and openness to experience. Once the first session was completed and after a few hours had elapsed, the second session was made available to the same participants. This session consisted of the OSPAN task and the Portrait Values Questionnaire (PVQ-RR) (Schwartz et al., 2012). All behavioural tasks were built using PsychoJS, the online counterpart of PsychoPy (Peirce et al., 2019), and then hosted on Pavlovia (pavlovia.org), whereas all scales and questionnaires were built and hosted on Typeform (typeform.com). Each session lasted around 20 minutes and participants were rewarded a total of £7.00. All parts of the study followed the University of Malta’s research code of ethics and ethical clearance procedures.

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2.3 Conclusion and Summary

This thesis comprises of three studies, with all measures relating to these studies being incorporated into a comprehensive online two-session data collection exercise. In the first study, the focus is on the social mechanisms related to worldviews. In the second and third studies the focus shifts to investigating the individual differences in inhibitory control and cognitive flexibility, within the context of worldviews. Taken together, these studies aim to provide evidence for the significance of investigating individual differences in cognitive processing whilst also contributing to the conceptualisation and empirical study of the social-cognitive mechanisms of worldviews.

Chapter 3

Study 1

Worldviews and the Role of Social Values That Underlie Them

The overarching aim of this thesis is to investigate individual differences in cognitive processing, with particular emphasis on worldviews. However, before exploring the cognitive processing underlying worldviews, it is worth developing a more comprehensive understanding of worldviews. The investigation of worldviews naturally solicits the questions of how they arise and what purpose they serve. Worldviews, like other belief systems, arise out of the combination of a set of related beliefs overlapping in terms of substantive content or shared functionality. The understanding of belief systems and how different beliefs bind together has been a relatively popular focus of social research (Homer-Dixon et al., 2013; Sartori, 1969; van Prooijen & Kuijper, 2020). From political ideologies to religious beliefs, various studies have suggested that belief systems need not just be contained within the individual but rather may also exist across individuals (Wagner & Hayes, 2005), facilitating ways of developing alliances with others, maintaining a shared reality, and extending the lifespan of the belief system beyond the believers themselves (Usó-Doménech & Nescolarde-Selva, 2016; van Prooijen & Kuijper, 2020). It follows, therefore, that belief systems have an important role in both personal identity and society, serving the psychological needs of the individual as well as the institutionalised power structures of society. More relevant to this chapter is the need to understand how elements of belief systems, such as values (Usó-Doménech & Nescolarde-Selva, 2016), play a role in worldviews. From an empirical standpoint, the significance of this undertaking is evident when considering the

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multifaceted nature of beliefs that render the investigation of the underlying cognitive processing a challenging feat. Dissecting worldviews, by identifying the values that underlie them, is an essential preliminary step that will facilitate the subsequent investigations that follow in the upcoming chapters (Chapters 4 and 5). Moreover, from a social implication standpoint, this investigation is significant when considering the highly divided world we live in. For instance, religious beliefs and political ideologies are known to exert a significant influence on social cohesion (Cuevas & Dawson, 2021). Accordingly, it is not unreasonable to hypothesise that worldviews too may play such a role. Investigating the values that underlie our worldviews is a crucial step towards understanding the motives and perspectives of individuals that enable effective communication and collaboration amongst diverse actors.

In this chapter, I start by defining worldviews and values and follow with forging a theoretical linkage between the two. I then proceed by reporting the findings of a study of this theoretical overture before concluding with a discussion of the implications on the subsequent studies.

3.1 Worldviews

Beliefs and belief systems share several essential properties and features, namely: they vary in generalisability and strength; they may arise and be reinforced by experience, culture, society, philosophy, and theology; they are instrumental in helping us provide meaning of the world, ourselves and our place in society; and they also share a strong relationship with behaviour (Usó-Doménech & Nescolarde-Selva, 2016). It is reasonable, therefore, to propose that we are evolved to have beliefs and use them to navigate the world around us. Buhagiar and Sammut (2020) explain how beliefs serve an extended dual purpose *of* describing elements in our environment *for* the purpose of

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guiding action. Similar sentiments have been subsequently proposed by Power et al. (2023) with regards to world-making. This involves worldviews, that is, a particular set of generalised beliefs that we use to describe ourselves and the world around us. Worldviews encompass beliefs that shape our outlook on life, and they are pertinent in providing meaning to our reality and our understanding of how we fit within it (Koltko-Rivera, 2004). In an extensive review of the literature on worldviews, Koltko-Rivera (2004) has pointed out that the construct of worldviews has oftentimes been defined and named in a multitude of ways, from cultural and value orientations aimed at conceptualising worldviews at a social level (Hofstede, 1984; Schwartz, 2006; Schwartz, 1992), to philosophical outlooks aimed at conceptualising worldviews at an individual level (Maslow, 2012). Almost two decades later, this scenario on worldviews remains largely the same, lacking a unified understanding of the concept. In this thesis, and similar to Koltko-Rivera (2004), worldviews are defined as representations of the structure of how and what people think. Crucially, their function lies in how they operate to enable subjects to adapt their responses to present ecological demands (Sammut, 2019; Sammut et al., 2022). As outlined in Chapter 1, a number of theoretical constructs have been shown to fall in line with this definition of worldviews (Sammut, 2019; Sammut et al., 2022), namely: (i) symbolic universes (Salvatore et al., 2018), (ii) social axioms (Leung & Bond, 2009), (iii) moral foundations (Haidt, 2012), and (iv) deep stories (Hochschild, 2016). Indeed, with the aim to unify these constructs, Sammut et al. (2022) have proposed a novel five-factor typology that includes the: (i) *Localised*, (ii) *Orthodox*, (iii) *Pragmatist*, (iv) *Reward*, and (v) *Survivor* worldviews (Sammut et al., 2022). As summarised in Table 2, each worldview captures a symbolic universe, social axiom, moral foundation, and a deep story profile. The *Localised* worldview involves the desire to fix problems or address social issues. The *Orthodox* worldview seeks to preserve the

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status quo. The *Pragmatist* worldview is protective and revolves around self-interest. The *Reward* worldview centres around determination to work hard to obtain a desired goal. Lastly, the *Survivor* worldview involves fatalism, distrust in others and the need to overcome adversity (Sammut et al., 2022). Nevertheless, it is worth noting that what differentiates these worldviews from the other similar constructs is the way in which they are measured, namely through vignettes. Vignettes are better suited for identifying worldviews because they provide a rich holistic formulation that may otherwise not be captured through the sum of a sequence of Likert scales. Specifically, the worldview vignettes offer a flexible approach in which, given a narrative, respondents are allowed to formulate and consider a generalised situational outlook when interpreting them (Sammut & Gaskell, 2010). For instance, when interpreting a *Survivor* worldview, a respondent in India might be despairing about food whilst a respondent in the USA might be despairing about mortgages. Ultimately, despite the differences in personal experiences that respondents draw upon, the psychological experience remains similar.

Table 2*A Syncretic Conceptualisation of Worldviews as Proposed by Sammut et al. (2022)*

Worldviews	Symbolic Universes	Social Axioms	Moral Frameworks	Deep Stories
<i>Localised</i>	Interpersonal Bond	Social Complexity	Loyalty/Betrayal	Team Player
<i>Orthodox</i>	Ordered Universe	Religiosity	Purity/Sanctity	Worshipper
<i>Pragmatist</i>	Niche of Belongingness	Fate Control	Fairness/Reciprocity	Rebel with a Cause
<i>Reward</i>	Caring Society	Reward for Application	Harm/Care	Cosmopolitan
<i>Survivor</i>	Others' World	Social Cynicism	Authority/Respect	Cowboy

3.2 Social values

Belief systems and values are linked to each other because the former allows the manifestation of the latter (Bond, Leung, Au, Tong, & Chemonges-Nielson, 2004; Usó-Doménech & Nescolarde-Selva, 2016). One could argue that the distinction resembles that between genotype and phenotype in evolution. Values are formulated on the basis of what an individual or social group deems to be important, desirable or favourable, playing a key role in bridging the gap between individual and society (Schwartz, 1992, 2012). One of the most established theories of values is the one outlined by Schwartz (1992). In his theory Schwartz (1992) defines values as individually held subjective beliefs that (a) are strongly associated with feelings (b) refer to desirable goals that motivate action (c) are ordered in level of relative importance, and (d) set a standard on which judgements and decisions are made. Furthermore, values are also defined as universal because they are thought to satisfy three universal requirements of human existence, namely, the needs of individuals as human beings, of harmonious social interaction, and of survival and welfare of social groups (Schwartz, 2012). Schwartz's theory of values organises them in the form of a circumplex consisting of 10 broad value types, namely: (1) self-direction (independent thought and action), (2) stimulation (excitement towards life), (3) hedonism (gratification for oneself), (4) achievement (personal success), (5) power (authority and status), (6) security (safety and stability), (7) conformity (following social norms), (8) tradition (respecting customs), (9) benevolence (well-meaning towards others), and (10) universalism (respecting of all people and nature) (Schwartz, 1992, 2012). Empirical evidence for this model emerged from smallest space analysis that examined the spatial relationships amongst the values (Schwartz, 1992). Notably, Schwartz et al. (2012) have recently developed a more

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detailed value circumplex consisting of 19 different value types that can, however, be collapsed into the original 10. Additional analysis of the original 10 value circumplex revealed a two-dimensional structure (Schwartz, 1992, 2012). On the one hand, *Conservation versus Openness to Change* reflects the tension between values relating to preservation or change of the status quo (Schwartz, 1992). On the other hand, *Self-Enhancement versus Self-Transcendence* reflects the tension between values relating to personal or other-related interests and successes (Schwartz, 1992). Schwartz's theory has been validated across a wide range of countries and cultures, and the measures of these values (i.e., the Schwartz Values Survey [SVS]), has demonstrated strong psychometric properties (Puurko et al., 2011; Schwartz et al., 2012; Schwartz & Boehnke, 2004). In addition, meaningful relationships have been reported between values and beliefs (Maslow, 2012; Schwartz, 1992).

3.3 The Hypothesised Relationship Between Worldviews and Values

Worldviews and values may be thought of as comprising a hierarchical structure with values being the more abstract and worldviews being the less abstract (Homer & Kahle, 1988). Earlier it was noted that values are universal and applicable regardless of context (Schwartz, 2012). Particularly, since values transcend specific situations and contexts, they offer an opportunity to understand the motivational constituents that make up one's avowed worldview. The values that I refer to in this study are the higher order values identified by Schwartz (1992, 2012). Though Schwartz's value theory and the concept of worldviews are distinct frameworks having different foci and applications, I believe there is a degree of correspondence between the two. Particularly, the two higher order values outlined seemingly correspond with Triandis' dissection of individualism-collectivism dimensions, which have been linked to cultural worldviews (Triandis, 1989;

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Triandis et al., 1988). Due to this, Schwartz's higher order value dimensions, that are more individual-oriented, offer an opportunity to link values to our conceptualisation of worldviews. Indeed, with reference to Schwartz's value theory, empirical evidence has provided support for a meaningful relationship between individually held beliefs and generalised values (Feldman, 2020; Leung et al., 2007). For instance, Feldman (2020) reported that despite evidence that values and moral foundations are unique and separate constructs, findings still indicate a telling relationship between the two. In one contrast, the *Harm/Care* and *Fairness/Reciprocity* foundations were associated with higher benevolence and universalism values when collapsed under the higher order value of self-transcendence. In the other contrast, the *Loyalty/Betrayal*, *Authority/Respect*, and *Purity/Sanctity* foundations were associated with higher tradition, conformity, and security values when collapsed under the higher order value of conservation (Feldman, 2020). These findings corroborate an earlier meta-analysis examining the value-attitude relationship based on moral foundation theory (Haidt & Joseph, 2008), where self-transcendence values were found to be related to the *Fairness* foundation/pro-environmental attitudes and the *Care* foundation/pro-social attitudes (Boer & Fischer, 2013). Conversely, conservation values were found to be related to the *Purity* foundation/religious attitudes and the *Authority* foundation/political attitudes (Boer & Fischer, 2013). With reference to research on social axioms and values, *Social Complexity* has been reported to positively correlate with self-direction and benevolence values, *Reward for Application* has positively correlated with conformity values, and *Fate Control* and *Religiosity* have positively correlated with tradition values (Leung et al., 2007). Though such studies do not directly tap into the construct of worldviews being investigated here, they are meaningful in their implications on the construct (see Table

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2). For this reason, such findings offer a strong basis for predicting a relationship between worldviews and values (see Table 3 for summary of predictions).

Table 3

Summary of Worldview Descriptions and Predictions

Worldview	Summary Description	Dominant Supporting Values
Localised	Positive outlook of people and the world, contributing towards the wellness of others.	Self-Transcendence Openness to Change
Orthodox	Willing to contribute to the wellness of others without the desire to change the status quo.	Self-Transcendence Conservation
Pragmatist	Willing to bend the rules for loved ones to navigate an unfair world.	Self-Enhancement Openness to Change
Reward	Hard working with a strong drive for achievement, prioritising in-group over others.	Self-Enhancement Conservation
Survivor	Fatalistic and cynical view of people and the world.	Conservation

The *Localised* worldview is associated with a generally positive outlook of people and the world, with a strong willingness to contribute towards the wellness of others.

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Furthermore, it is also associated with flexible and open views. As outlined in Table 2, this worldview is conceptually linked to the *Social Complexity* social axiom, amongst others. *Social Complexity* has been positively linked to values of self-transcendence (Leung et al., 2007). Furthermore, prosocial behaviour, the central underlying characteristic of the *Localised* worldview, has also been linked to values of self-transcendence (Boer & Fischer, 2013). In light of these findings, it is reasonable to expect that the *Localised* worldview will correlate positively with values of self-transcendence. Findings relating these beliefs to the values of openness to change, or conservation, are not entirely in sync. Specifically, the *Loyalty/Betrayal* foundation has been linked to values of conservation (Feldman, 2020), however, the *Social Complexity* social axiom has not been linked to either of the values of conservation or openness to change (Leung et al., 2007). These noncomplementary findings may be attributed to slight variations in each belief's underlying notions, or perhaps even to differing methodological approaches. Nevertheless, considering that the *Localised* worldview is conceptually linked to open mindedness, it is expected to positively correlate with values of openness to change. These expected linkages emphasise the significance of other-related interests and the resistance of maintaining a status quo for the *Localised* worldview.

The *Orthodox* worldview is associated with a generally positive outlook of people and the world, however, without the desire to change the status quo. For this reason, this worldview is characterised by rather rigid and convergent thinking, ready to accept the current state of matters with little challenge. Indeed, in a study on views towards recreational cannabis use, Sammut et al. (2022) reported that the *Orthodox* worldview stood out from the other worldviews in predicting opposition towards recreational cannabis use. The *Orthodox* worldview is conceptually linked to the *Purity/Sanctity* foundation and the *Religiosity* social axiom, both of which were correlated with values

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of conservation (Boer & Fischer, 2013; Feldman, 2020; Leung et al., 2007). Furthermore, *Religiosity* was also found to be positively linked to values of self-transcendence (Leung et al., 2007). With consideration to these findings, it is expected that the *Orthodox* worldview correlates positively with values of self-transcendence and conservation.

The *Pragmatist* worldview is associated with distrust in social institutions and a relatively negative outlook of people and the world. Despite this, individuals who endorse the *Pragmatist* worldview also believe that one can easily navigate such a world if one is willing to adapt and bend the rules. This worldview is conceptually linked to the *Fairness/Reciprocity* foundation and the *Fate Control* social axiom, amongst others. It is worth noting that findings on the two belief systems are different, namely, the *Fairness/Reciprocity* foundation positively correlates with values of self-transcendence whereas *Fate Control* does not (Boer & Fischer, 2013; Feldman, 2020; Leung et al., 2007). Another conceptual link to this worldview includes the *Niche of Belongingness* symbolic universe. Salvatore et al. (2018) claim that this symbolic universe, along with *Interpersonal Bond*, may be seen as a source of bonding social capital (i.e., prioritising in-group identity and cohesion). For this reason, it will be expected that, like *Fate Control* but unlike the *Fairness/Reciprocity* foundation, this worldview will correlate negatively with values of self-transcendence (and so positively with values of self-enhancement). Additionally, due to the element of distrust in those with power, it is expected that the *Pragmatist* worldview will correlate positively with values of openness to change. In an early study investigating the relationship between values and trust in institutions, Devos et al. (2002) reported that levels of trust correlated positively with values that emphasise security, preservation, and tradition, that is, those values subsumed under the higher order value of conservation. The authors also reported that levels of trust correlated negatively with values that emphasise change and independent action, that is, those values subsumed

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under the higher order value of openness to change. These findings were later corroborated by Morselli et al. (2012) through a multilevel assessment carried out on cross-cultural datasets.

The *Reward* worldview is largely associated with hard work and a strong drive for achievement. Importantly, it is also characterised by obedience and respect of social norms. For this reason, an individual endorsing this worldview believes that life's consequences are generally always fair and deserved, especially if one is unable to exercise restraint over their actions that violate the status quo. The *Reward* worldview is conceptually linked to the *Harm/Care* foundation and the *Reward for Application* social axiom, amongst others. Findings linking the two beliefs to values have shown a positive link between the *Harm/Care* foundation and values of self-transcendence (Boer & Fischer, 2013; Feldman, 2020), and between the *Reward for Application* social axiom and values of conservation (Leung et al., 2007). As outlined earlier, the *Harm/Care* foundation represents the notion of looking after others. Although this aspect is shared with the *Reward* worldview, it is worth noting that possibly, for the *Reward* worldview, caring for others may arise as a by-product of the desire to be in a higher position (i.e., a parental/authority figure). Therefore, it is possible that the *Harm/Care* foundation is rooted in more egalitarian intentions in contrast to the *Reward* worldview. Due to this conceptual difference, it is expected that unlike the *Harm/Care* foundation, the *Reward* worldview positively correlates with values of self-enhancement. Furthermore, due to characteristics relating desire for authority and control to prevent harm, and in line with the findings on the *Reward for Application* social axiom, the *Reward* worldview is expected to correlate positively with values of conservation.

Lastly, the *Survivor* worldview is associated with a fatalistic and cynical view of people and the world. This negative view is also accompanied by significant distrust in

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society and its institutions. The *Survivor* worldview is conceptually linked to the *Authority/Respect* foundation which was found to correlate positively with values relating to conservation (Feldman, 2020). In addition, it is conceptually linked to the *Social Cynicism* social axiom which has correlated positively with the value of power but not with other values collapsed under the higher order values of self-transcendence and self-enhancement (Leung et al., 2007). For this reason, it is not theoretically evident how the *Survivor* worldview correlates with the self-transcendence/self-enhancement value tension. Nevertheless, considering the findings within the domain of moral foundations (Feldman, 2020) and findings linking fatalism to the values of conservation (Schwartz & Sagie, 2000), it can be reasonably expected that the *Survivor* worldview correlates positively with conservation values.

In summary it is predicted that:

(S1H1a) The *Localised* and (S1H1b) *Orthodox* worldviews will correlate positively with self-transcendence and negatively with self-enhancement; (S1H1c) the *Pragmatist* and (S1H1d) *Reward* worldviews will correlate positively with self-enhancement and negatively with self-transcendence;

(S1H2a) The *Orthodox*, (S1H2b) *Reward*, and (S1H2c) *Survivor* worldviews will correlate positively with conservation and negatively with openness to change; (S1H2d) the *Localised* and (S1H2e) *Pragmatist*, worldviews will correlate positively with openness to change and negatively with conservation;

(S1H3a) The *Localised* and (S1H3b) *Orthodox* worldviews will predict higher self-transcendence than the *Reward* and *Pragmatist* worldviews;

(S1H4a) The *Pragmatist* and (S1H4b) *Reward* worldviews will predict higher self-enhancement than the *Localised* and *Orthodox* worldviews;

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(S1H5a) The *Localised* and (S1H5b) *Pragmatist*, worldviews will predict higher openness to change than the *Orthodox*, *Reward*, and *Survivor* worldviews; and lastly,

(S1H6a) The *Orthodox*, (S1H6b) *Reward*, and (S1H6c) *Survivor* worldviews will predict higher conservation than the *Localised* and *Pragmatist* worldviews.

3.4 Method

This study followed the methodology outlined in Chapter 2. For a detailed description of the sample and procedure, please refer to Section 2.1.1 and Section 2.1.2.

3.4.1 Measures

Worldviews. Worldviews were measured through a scale incorporating a list of 5 distinct vignettes, each of which characterising one of the worldviews (see, Appendix B.1). Further detail about this measure may be found in Section 2.1.2 in Chapter 2.

Social values. The Portrait Values Questionnaire (PVQ-RR) is an alternative to The Schwartz Value Survey (SVS) that is more suitable for online administration. It comprises 57 short verbal portraits that describe a person's goals and aspirations, implicitly tapping into a particular value (see, Appendix B.2). There are 3 verbal portraits for each of the 19 values. Typically, all portraits are gender-matched with the respondent, however, for the present study, gender neutral pronouns (they/their) were used to facilitate the online administration of the questionnaire. Participants were asked to complete the PVQ-RR by indicating the extent to which they believe they are like the person being described in each of its portraits, using a 5-point Likert scale. A 5-point Likert scale was adopted to be consistent with other scales being used in the questionnaire. PVQ-RR allowed for the measure of the 10 personal values, originally

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identified by Schwartz (1992), the refined 19 values (Schwartz et al., 2012), and 4 higher order values (Schwartz et al., 2012). The questionnaire demonstrates good psychometric properties for measuring personal values in non-clinical groups (Schwartz et al., 2012). Particularly, the mean Cronbach's alpha reliabilities for the 4 higher values in the present sample were: .88 self-transcendence, .79 self-enhancement, .84 openness to change, and .80 conservation.

3.4.2 Data Analyses

The 19 values, outlined by Schwartz (2012), were calculated by taking the average rating across the 3 verbal portraits that are related to the particular value (Schwartz, 2016). Following this, the 4 higher order values were calculated as follows: self-transcendence was calculated by computing the mean score of the values of universalism and benevolence; self-enhancement was calculated by computing the mean scores of the values of achievement and power; openness to change was calculated by computing the mean score of the values of self-direction and hedonism; and conservation was calculated by computing the mean score of the value of security, tradition, and conformity (Schwartz, 2016). As per the PVQ-RR scoring and analysis instructions recommended by Schwartz (2016), centred value scores were calculated to correct for scale use bias. This was especially recommended since the primary modes of analyses for this study was correlation analysis and linear regression. Scores were centred for all values by calculating the mean rating across all items (MRAT) and subtracting this from each of the value scores (Schwartz, 2016).

To examine differences between worldviews, dummy variables for each worldview were created. Separate dummy regression analyses were then carried out including all the dummy worldviews, with the *Localised* worldview as the reference

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category and each individual higher order value as the dependent variable. Since, for the purposes of this study, there is no substantive or theoretical justification that favours selecting one worldview as a reference category over another, the *Localised* worldview was selected on the basis that it is the most common worldview that participants identify with (Darlington et al., 2016). To control for known sex differences and cultural differences in value orientation (Magun et al., 2016; Schwartz & Rubel, 2005), all analyses entailed a two-block hierarchical model. With reference to cultural differences, since participants resided in a disproportionate variety of countries, these were grouped together in terms of continent. In the two-block hierarchical model, gender (male, female) and continent (Africa, America, Australia, Europe) were included in the first block and the dummy coded worldviews were included in the second block. No issues of collinearity were detected in any of the analyses.

3.5 Results

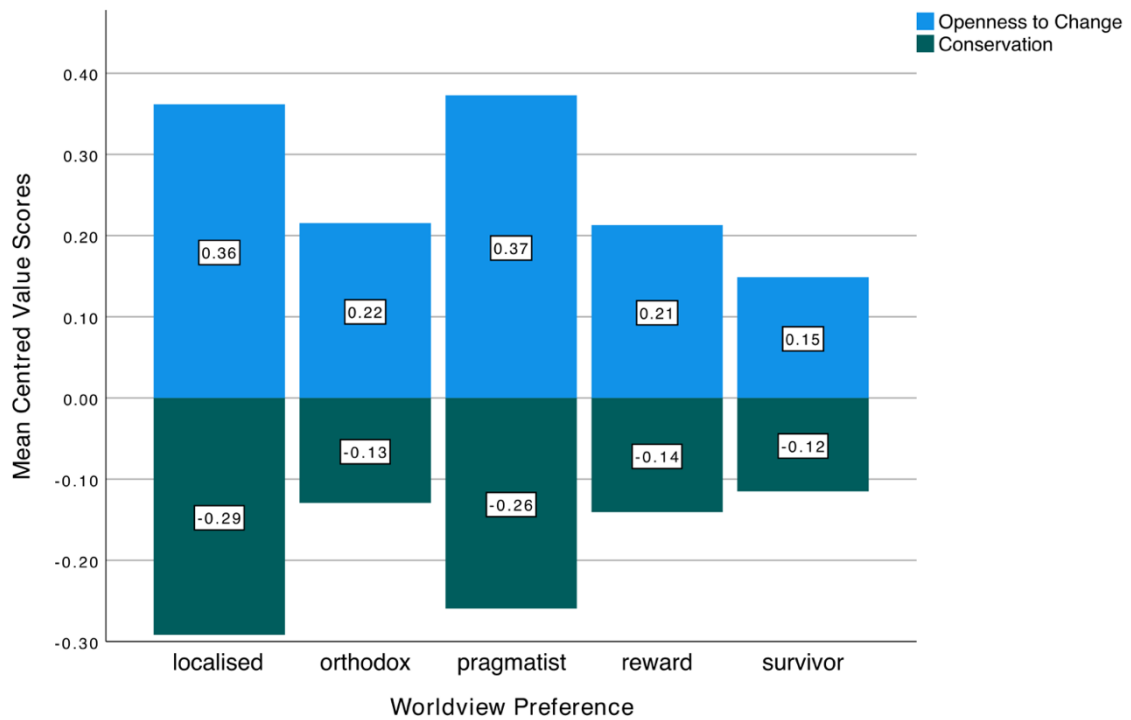
Prior to carrying out correlation analyses, the data was assessed for normality. All skewness and kurtosis values were less than 2 and 4 respectively, therefore, the data was deemed to be normally distributed (Mishra et al., 2019). With reference to value orientations, self-transcendence tended to be scored highest by those preferring the *Localised* worldview ($M = .54, SD = .38$) and lowest by those preferring the *Reward* worldview. ($M = .27, SD = .31$). Furthermore, self-enhancement tended to be scored the highest by those preferring the *Reward* worldview ($M = -.36, SD = .38$) and lowest by those preferring the *Orthodox* worldview ($M = -.76, SD = .54$). As for openness to change, it tended to be scored the highest by those preferring the *Pragmatist* worldview ($M = .37, SD = .32$) and lowest by those preferring the *Survivor* worldview ($M = .15, SD = .46$). Finally, conservation tended to be scored the highest by those preferring the *Survivor*

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worldview ($M = -.12$, $SD = .36$) and lowest by those preferring the *Localised* worldview ($M = 3.27$, $SD = .54$). These findings are illustrated in Figure 1a and 1b.

Figure 1a

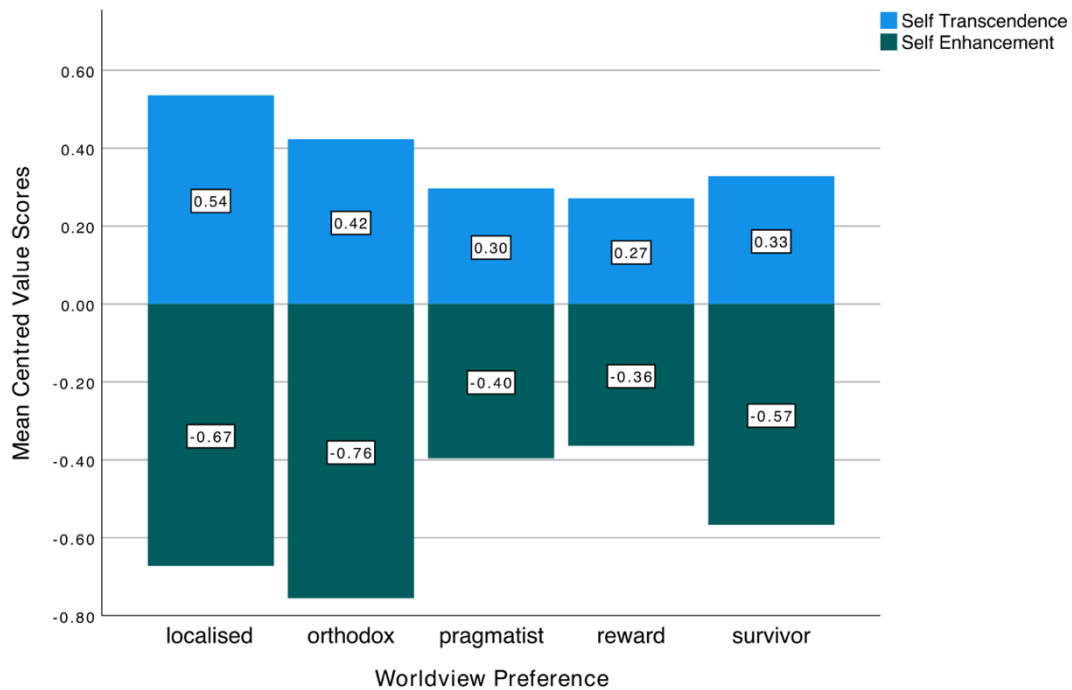
Mean (Centred) Score for Openness to Change and Conservation Grouped by Worldview



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Figure 1b

Mean (centred) Score for Self-transcendence and Self-enhancement Grouped by Worldview



3.5.1 Correlations Between Worldviews and Values

The p-values reported in this section have been Bonferroni corrected in order to mitigate the risk of Type 1 errors arising from multiple comparisons. An overview of the correlations between the ratings for each individual worldview and the scores for each of the four higher-order values is outlined in Table 4. There was a weak positive correlation between the *Localised* worldview and self-transcendence, $r = .17$, $p = .045$, 95% CI [0.04, 0.28] and a weak negative correlation between the *Localised* worldview and self-enhancement, $r = -.17$, $p = .040$, 95% CI [-0.28, -0.04], therefore, S1H1a is supported. In contrast, there was a weak negative correlation between the *Reward* and *Survivor* worldviews and self-transcendence, $r = -.19$, $p = .015$, 95% CI [-0.07, -0.31], and $r = -.21$, $p = .005$, 95% CI [-0.40, -0.02], respectively. For this reason, S1H1c and S1H1d

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are only partly supported. The *Reward* worldview resulted in a weak positive correlation with conservation, $r = .18, p = .015, 95\% \text{ CI } [0.06, 0.30]$, consequently S1H2b is partially supported. Similarly, the *Orthodox* worldview resulted in a weak positive correlation with conservation, $r = .19, p = .015, 95\% \text{ CI } [0.07, 0.30]$, therefore, S1H2a is partially supported. Since no correlations transpired between the *Orthodox* worldview and the values of self-transcendence and self-enhancement, S1H1b is not supported. Moreover, since no correlations transpired between the *Localised* worldview and self-transcendence, and the *Survivor* worldview and self-enhancement, S1H2c and S1H2d are also not supported. Lastly, no correlations transpired between the *Pragmatist* worldview and values, therefore, S1H1c and S1H2e are not supported.

Table 4*Correlations Between Higher Order Values and Worldviews*

Variable	1	2	3	4	5	6	7	8	9
1. Self-Transcendence ^a	-								
2. Self-Enhancement ^a	-.627*	-							
3. Openness to Change ^a	-.022	.106	-						
4. Conservation ^a	-.290*	-.308*	-.668*	-					
5. Localised	.165*	-.166*	-.018	.039	-				
6. Pragmatist	-.030	.084	.112	-.130	.058	-			
7. Orthodox	-.033	-.108	-.148	.188*	.226*	.057	-		
8. Reward	-.189*	.104	-.149	.180*	.186*	-.005	.292*	-	
9. Survivor	-.208**	.122	-.107	.077	-.066	.204*	-.084	-.005	-
<i>M</i>	.416	-.562	.315	-.236	4.08	3.72	3.42	2.89	2.60
<i>SD</i>	.354	.555	.388	.369	.794	.985	1.026	1.220	1.174

^aCentred value scores* $p < .05$. ** $p < .01$

3.5.2 Regression Analyses

To investigate the influence of worldviews on higher order values (see Figure 1A and 1B), a series of hierarchical regression models, with each of the four higher order values as the dependent variable, was carried out. As noted earlier, the first block of the model analysed the influence of the demographic variables (gender, continent) whereas the second block analysed the influence of worldviews.

The model predicting self-transcendence was significant, $R^2 = .186$, $F(9, 241) = 6.105$, $p < .001$. In this model, the worldviews alone contributed to 11.5% of the variance. Relative to the *Localised* worldview, all but the *Orthodox* worldview resulted in lower self-transcendence: the *Reward*, $\beta = -.261$, $t(241) = -4.037$, $p < .001$, 95% CI [-0.39, -0.13], *Survivor*, $\beta = -.181$, $t(241) = -2.191$, $p = .029$, 95% CI [-0.34, -0.02], and *Pragmatist* worldview, $\beta = -.263$, $t(241) = -5.072$, $p < .001$, 95% CI [-0.37, -0.16], predicted lower self-transcendence scores. Consequently, S1H3a and S1H3b are supported.

The model predicting self-enhancement was significant, $R^2 = .096$, $F(9, 241) = 2.844$, $p < .01$. In this model, the worldviews alone contributed to 6.7% of the variance. Relative to the *Localised* worldview, the *Reward*, $\beta = .302$, $t(241) = 2.834$, $p = .005$, 95% CI [0.09, 0.51], and *Pragmatist* worldview, $\beta = .283$, $t(241) = 3.304$, $p < .001$, 95% CI [0.11, 0.45], predicted higher self-enhancement scores. As a result, S1H4a and S1H4b are supported.

The model predicting openness to change was significant, $R^2 = .112$, $F(9, 241) = 3.372$, $p < .001$. In this model, the worldviews alone contributed to 4.6% of the variance. Relative to the *Localised* worldview, the *Reward*, $\beta = -.167$, $t(241) = -2.272$, $p = .024$, 95% CI [-0.31, -0.02], and *Survivor* worldview, $\beta = -.228$, $t(241) = -2.418$, $p = .016$, 95%

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CI [-0.41, -0.04], predicted lower openness to change scores. Since no significant differences emerged between the *Localised*, *Pragmatist*, and *Orthodox* worldviews, S1H5a and S1H5b are only partly supported.

Lastly, the model predicting conservation was also significant, $R^2 = .131$, $F(9, 241) = 4.030$, $p < .001$. In this model, the worldviews alone contributed to 4.3% of the variance. Relative to the *Localised* worldview, the *Reward*, $\beta = .160$, $t(241) = 2.310$, $p = .022$, 95% CI [0.02, 0.30], *Survivor* worldview, $\beta = .201$, $t(241) = 2.258$, $p = .025$, 95% CI [0.03, 0.38], and *Orthodox* worldview $\beta = .191$, $t(241) = 2.326$, $p = .021$, 95% CI [0.03, 0.35], predicted higher conservation scores. Therefore S1H6a, S1H6b, and S1H6c are supported.

3.6 Discussion

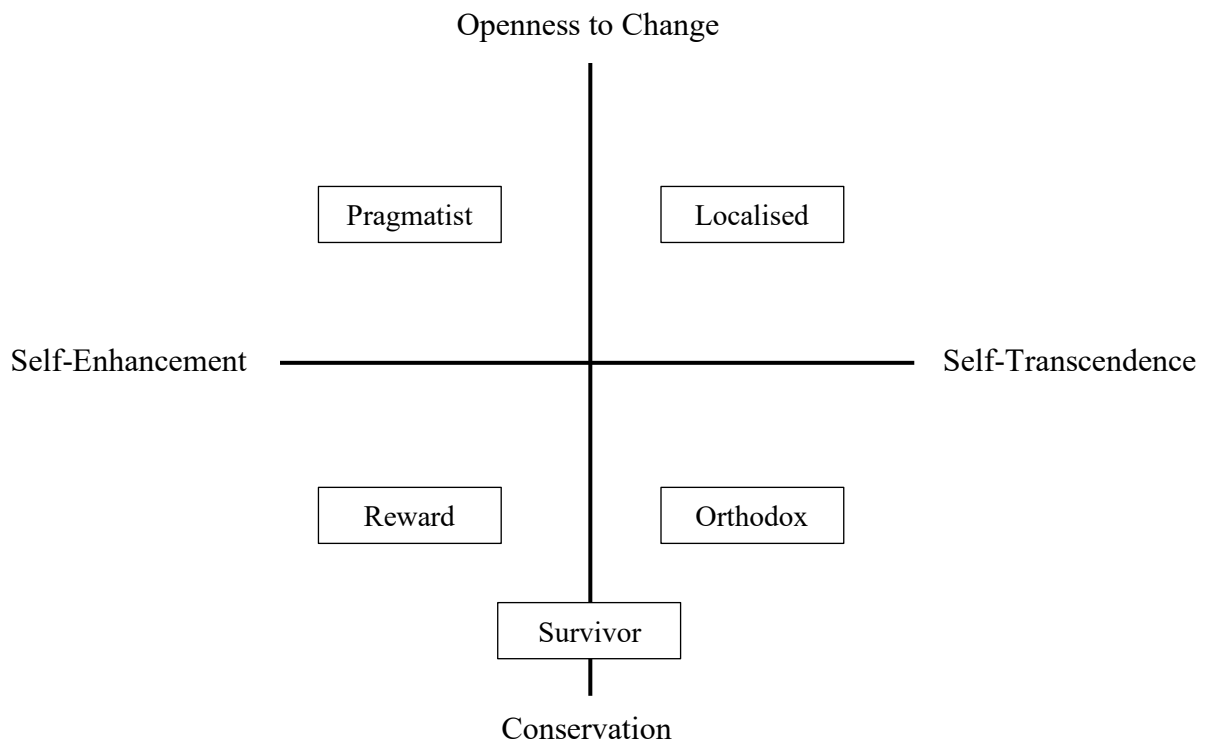
This study examined the relationship between worldviews and values. Correlational analysis and a series of hierarchical linear regressions were carried out to assess this relationship as well as the influence that worldviews exert on specific higher order values. Findings show that, even though some belief systems, referred to herein as worldviews, are evidently different from each other, there are nevertheless unique points of convergence that may notably be attributed to underlying values (see Figure 2 for illustration of how worldviews map onto values). However, it is worth noting that the correlation analyses (within worldview differences) resulted in weaker findings than the regression analyses (between worldview differences). Since correlation analysis is known to be more sensitive to small sample sizes than regression analysis (Lipsey, 1990), it may be possible that the study was underpowered to detect linear relationships. It may also be the case that there are confounding variables that are influencing the relationship between worldviews and values. For instance, cultural and social contexts are known to

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influence the way individuals prioritise values and beliefs (Magun et al., 2016). This was controlled for in the regression analyses, however, bivariate correlation analyses do not allow for the possibility to control for other variables besides the relationship between the two variables being investigated. This may lend support to the notion that the worldviews construct is better suited for explaining a proportion of variance that may otherwise remain unaccounted for by the predictor variables, rather than describing linear relationships (Koltko-Rivera, 2004).

Figure 2

An Illustration of the 2-Dimensional Higher Order Value Structure Underlying Worldviews



The *Localised* and *Orthodox* worldviews both agree on the value of self-transcendence but disagree on the value of conservation. Therefore, an individual who endorses either of these two worldviews is likely to be someone who subscribes to an

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egalitarian view of the world motivated to go beyond selfish desires to help and connect with others. However, what differentiates these two worldviews is the extent to which one is willing to act autonomously and freely. Those who endorse a *Localised* worldview are open to independence and are unrestricted by the need to abide by social order, whereas those who endorse an *Orthodox* worldview are more self-restricting and more comfortable acting within the confines of tradition and society. Though not empirically investigated, this difference between the two might be attributed to the sense of religiosity or belief in higher supremacy that characterises the *Orthodox* worldview. Earlier, the *Orthodox* worldview was proposed to be conceptually linked to the *Ordered Universe* symbolic universe, the *Religiosity* social axiom, the *Purity/Sanctity* moral foundation, and the *Worshipper* deep story profile. Notably, these have all been described as involving an underlying religious notion (Haidt, 2012; Hochschild, 2016; Leung & Bond, 2009; Salvatore et al., 2018). It could, therefore, be the case that the *Orthodox* worldview is linked to conservatism due to the tendency to adhere to religious teachings and the security that comes with that, undermining an element of agency and self-direction.

Like the *Orthodox* worldview, the *Reward* and *Survivor* worldviews also value conservation. The *Reward* worldview has been conceptually linked to the *caring society* symbolic universe, the *Reward for Application* social axiom, the *Harm/Care* moral foundation, and the *Cosmopolitan* deep story profile. A common feature underlying these beliefs is the importance of forming coalitions, developing trust, and living peacefully with others (Haidt, 2012; Hochschild, 2016; Leung & Bond, 2009; Salvatore et al., 2018). A reason for the link between the *Reward* worldview and conservation may arise out of the desire of maintaining peace within one's group. For this worldview, it is possible that such peace is thought to be best achieved by exercising control and establishing and adhering to group norms. On a different note, the *Survivor* worldview, that has been

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conceptually linked to fatalistic and cynical beliefs, may be linked to conservation because of a sense of powerlessness. That is, even though one is distrustful of society, one would rather let matters remain as they are rather than risk having to adapt to something new. Put simply, for the *Survivor* worldview, “it is better the devil you know than the angel you do not know”. Unlike the *Orthodox* worldview, the *Reward* and *Survivor* worldviews do not value self-transcendence. Rather, the *Reward* worldview, in particular, has been linked to self-enhancement. Self-enhancement represents personal focus and self-protection. However, for the *Reward* worldview, the positive link with self-enhancement is not necessarily solely highlighting self-serving motives but could, more fittingly, be highlighting the importance of ingroup unity over outgroup helping. Therefore, for this worldview, ingroup favouritism may also explain a positive link with self-enhancement. The *Survivor* worldview is associated with cynicism. Early studies found empirical evidence linking cynicism with lower self-esteem and lower levels of interpersonal trust (Singelis et al., 2003). Such negative portrayals of the self and others may be a possible cause that explains why the *Survivor* worldview devalues self-transcendence and is not particularly linked to self-enhancement.

Similar to the *Reward* worldview, the *Pragmatist* worldview also has a negative relationship with self-transcendence and a positive relationship with self-enhancement. The *Pragmatist* worldview was earlier conceptually linked to *Niche of Belongingness* symbolic universe, the *Fate Control* social axioms, the *Fairness/Reciprocity* moral foundation, and the *Rebel with a cause* deep story profile. An underlying theme of these beliefs is a preference for individual autonomy coupled with reciprocal favouritism (Haidt, 2012; Hochschild, 2016; Leung & Bond, 2009; Salvatore et al., 2018). Essentially, the *Pragmatist* worldview utilises the “tit-for-tat” strategy to navigate the world. This strategy, which is synonymous with reciprocal altruism (Trivers, 1971), is

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based on the principle that one reciprocates the other's actions, collaborating only with individuals who are willing to return the favour (Axelrod & Hamilton, 1981). The "tit-for-tat" strategy is an essential survival mechanism because it helps to protect self-interest whilst living peacefully with others (Axelrod & Hamilton, 1981). It could be the case that the *Pragmatist* worldview is linked with self-enhancement because their actions are primarily driven by selfish intentions despite seeming to be altruistic in nature. The *Pragmatist* worldview potentially presents itself as a good example of how, ultimately, reciprocal altruism is rooted in a self-serving agenda (Dawkins, 1989).

The conceptual link between the *Pragmatist* worldview and openness to change differentiates it from the *Reward* worldview. A reason for this could be that individuals who endorse the *Reward* worldview find security in their social group whereas those with a *Pragmatist* worldview do not. Earlier, the *Pragmatist* worldview was related to a negative view of people and society, making them less likely to depend on others. This in turn makes individuals who endorse this worldview more likely to think and act independently, offering an explanation as to why one would be less willing to act within societal constraints.

3.7 Conclusion

The objective of this inquiry constitutes a starting point for investigating the cognitive correlates of worldviews. A key question that arises is whether worldviews are marked by individual differences in cognition that result out of inherent dispositions that incline some individuals towards a worldview more strongly than others, or whether, as Sammut (2019) proposed, the worldview repertoire is accessible to all individuals with its utility exclusively contingent on situational circumstances. Sammut (2019) proposes that individuals are able to change worldviews to ensure adaptation should their life

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conditions change. In this way, an individual pursuing a *Reward* worldview may, following a series of unfortunate events, emerge with a *Survivor* worldview that enables that individual to face adversity with grit even though there may be little to no personal gain. In essence, human subjects equipped with more or less similar cognitive power or prowess, as it were, should not be inclined one way or another relative to any particular worldview. Such inclinations should accrue solely as a consequence of life circumstances. Empirical study is required to determine whether this is indeed the case or whether, by contrast, the endorsement of worldviews is underlined by individual differences in cognition that incline people in determined directions. The following studies aim to do precisely this by attempting to link worldviews to certain cognitive processes; the second study (Chapter 4) investigates the relationship between worldviews and inhibitory control ability, whereas the third study (Chapter 5) investigates the relationship between worldviews and cognitive flexibility.

Chapter 4

Study 2

An Individual Differences Investigation of Inhibitory Control and Their Role in Worldviews

The first study (Chapter 3) showed that, even though worldviews appear to be very different from one another, there are unique points of convergence that may be attributed to values. Building upon this insight, the intention of the second study is to apply these findings to the investigation of the relationship between worldviews and cognitive abilities, particularly, those relating to self-regulation. Self-regulation broadly entails the processes that are necessary for managing one's own thoughts, feelings, and behaviour (Nigg, 2017). Inhibitory control is one such process that is necessary for successful self-regulation (Nigg, 2017; Tiego et al., 2018). It describes the mechanisms that allow the suppression of goal irrelevant behaviour in order to respond in a way that is appropriate for the given situation (Tiego et al., 2018). Studies investigating individual differences in self-regulation have shown that it is heavily dependent on the experiences, motives, and needs of the individual (e.g., Aspinwall, 1998; Baars et al., 2017; Hofer et al., 2011; Zimmerman, 2008). Meaningful individual differences within a variety of contexts have also been found in inhibitory control (e.g., Amodio et al., 2007; Buechner et al., 2020; Inzlicht et al., 2009). For instance, inhibitory control has been linked to better academic performance (e.g., Pascual et al., 2019), and mental and physical health (e.g., Bartholdy et al., 2019; Schachar et al., 2000). Notably, from a developmental perspective, it has also been linked to more socially acceptable behaviour (e.g., Bouhours et al., 2021; Hassan & Schmidt, 2022). Although there has been a lot of research carried out on the

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relationship between inhibitory control and socioemotional development (e.g., Bouhours et al., 2021; Hassan & Schmidt, 2022), less is known about the relationship between inhibitory control and other socially relevant factors, such as the beliefs we hold about society. Inhibitory control is essential in day-to-day life, helping us to control our impulses to make decisions that are in line with our goals and values. Considering this, socially situated investigations of inhibitory control may inform appropriate conflict resolution strategies, promoting a more harmonious society.

In this second study I aim to build upon evidence of individual differences in inhibitory control by investigating the role of beliefs, referred to as worldviews. I start by providing a summary of the literature on inhibitory control and worldviews that was reviewed in Chapter 1. I then proceed to outline the hypotheses and detail the methods of this inquiry. Finally, I conclude with a discussion around the potential implications of the findings for enhancing the understanding of the ways in which our cognitive abilities interact with worldviews.

4.1 Inhibitory Control

As outlined in Chapter 1, inhibitory control is considered to be a core component of executive function closely associated with other executive functions such as working memory updating and shifting (Miyake & Friedman, 2012). Friedman and Miyake (2004) deconstructed inhibitory control into three-related but separable inhibitory functions: 1) prepotent response inhibition, 2) resistance to distractor interference, and 3) resistance to proactive interference. Prepotent response inhibition is the ability to suppress automatic or habitual responses in favour of a more goal-direct response and is most commonly measured through the Go/No-Go task (Friedman & Miyake, 2004). Resistant to distractor interference refers to the ability to selectively attend to relevant information and ignore

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irrelevant or distracting information and is most commonly measured using a task like the Eriksen flanker task (Friedman & Miyake, 2004; Gärtner & Strobel, 2021). Lastly is resistance to proactive interference that describes the ability to navigate between previously relevant information and new information, typically measured with a form of cued recall task (Friedman & Miyake, 2004). It is worth noting that all three inhibitory control functions relate to different states of information processing: interference control entails selecting relevant information from irrelevant information (attentional inhibition), resistant to proactive interference entails resisting intrusions of information that at one point was necessary for goal-attainment (cognitive inhibition), and lastly, prepotent response inhibition entails suppressing previously learnt behavioural responses (behavioural inhibition) (Friedman & Miyake, 2004; Nigg, 2000). Given that prepotent response inhibition has been widely studied within the cognitive science literature and has shown considerable face validity (Friedman & Miyake, 2004; Nigg, 2000), it will be the focus for this study. In particular, the Go/No-Go task (adopted from Amodio et al., 2007) will be selected as the measure to evaluate prepotent response inhibition, hence, inhibitory control, in this study. This task requires participants to respond to a set of stimuli that include two different shapes, letters, or colours, one of which represents the Go stimulus and the other as the No-Go stimulus. The measures of interest in this task are the Go stimulus reaction time, the proportion of errors during No-Go trials (false alarm rate), the proportion of correct responses during the Go trials (hit rate), sensitivity between signal and noise (d'), response bias, and Go stimulus reaction time factoring in accuracy (inverse efficiencies).

Prepotent response inhibition has been shown to be linked to pro-social behaviour, however, such research has mostly been carried out from a developmental perspective targeting children, with little focus on adult populations (e.g., Hague et al.,

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2016; Nash et al., 2013; Veling et al., 2022). In addition, few studies have investigated the role of beliefs in inhibitory control and fewer still have investigated this using an objective behavioural measure of inhibitory control (e.g., Go/No-Go) (e.g., Amodio et al., 2007; Bernabel & Oliveira, 2017; Good et al., 2015; Inzlicht et al., 2009; Weissflog et al., 2010). The study carried out by Amodio et al. (2007) is perhaps the most influential study linking cognitive abilities to beliefs. This study revealed that a conservatist and liberal political ideology can predict differences in event-related potentials (ERPs) and behavioural measures during a Go/No-Go task. These findings have been replicated and extended by other researchers (e.g., Inzlicht et al., 2009; Weissflog et al., 2010), however, such studies remain limited to the study of political or religious ideologies. This second study aims to add to this body of research by investigating the relationship to worldviews.

4.2 Worldviews

Up till now in this thesis it has been established that worldviews, may be thought of as a set of belief systems that aid individuals to “make-sense” of themselves and the world around them (Usó-Doménech & Nescolarde-Selva, 2016). This conceptualisation in itself relates beliefs to cognitive schemas, mental representations that aid in the organisation of knowledge, beliefs, and expectations about the self and the environment (Brewer & Nakamura, 1984). The role of beliefs in cognitive processes has been extensively studied, however, investigation of this remains lacking within the domain of self-regulation. Only a handful of studies have explored the consequences of different beliefs or ideologies on self-regulation (Bertrams, 2020; Clarkson et al., 2015; Olcaysoy Okten & Saribay, 2019) such that little is yet known on how self-regulation and different belief systems interact. As reviewed in Chapter 1, the notion of worldviews was conceptualised by Sammut (2019) in order to offer a novel five-factor typology aimed at

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unifying the related concepts of symbolic universes (Salvatore et al., 2018), social axioms (Leung & Bond, 2009), moral foundations (Haidt, 2012), and deep stories (Hochschild, 2016). The five worldview typologies proposed include the *Localised*, *Orthodox*, *Reward*, *Pragmatist*, and *Survivor* worldviews (Sammut et al., 2022). The *Localised* worldview involves the desire to fix problems or address social issues. The *Orthodox* worldview seeks to preserve the status quo. The *Reward* worldview centres around determination to work hard to obtain a desired goal. The *Pragmatist* worldview is protective and revolves around self-interest. Lastly, the *Survivor* worldview involves fatalism and distrust in others (Sammut, 2019; Sammut et al., 2022). A more detailed review of worldviews may be found in Chapters 1 and 3.

4.3 Hypotheses

This second study aims to investigate the potential relationship between worldviews and inhibitory control. What perhaps provides substantial evidence for a relationship between worldviews and inhibitory control is the conceptual overlap between morality and self-control research (see, Hofmann et al., 2018). Haidt (2012) identified morality as being responsible for the function of constraining action and providing identity. Inarguably, constraining action entails self-control as it is similarly responsible for enabling the acquisition of a desired goal through the adjustment of one's own behaviour (Stock et al., 2016). Evidence for the link between self-control and moral foundations can be found in studies carried out on political ideology, where political ideology itself has strongly correlated with measures of moral foundations (Haidt, 2012). In a recent study investigating the link between political ideology and executive functioning, Buechner et al. (2020) reported that conservatives and liberals perform differently on working memory tasks of response inhibition and updating. Notably, they

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reported that conservatives are better at inhibiting their responses than liberals. This contrasts with earlier work carried out by Amodio et al. (2007) which reported that self-reported conservatism was associated with greater persistence in habitual response, and therefore a poorer response inhibition ability. All in all, these findings suggest that belief systems such as worldviews (Sammut, 2019; Sammut et al., 2022) could well be considered to be associated with the cognitive processes that underlie self-regulation, such as inhibitory control.

The *Localised* worldview is associated with the values of self-transcendence and openness to change (see, Chapter 3). Since the *Localised* worldview does not value traditionalism and other values related to conservation it is expected to be negatively linked with inhibitory control as evidenced by a higher false alarm rate, higher response bias, higher inverse efficiency score (IES), lower hit rate, and lower d' . This corresponds to findings from neuroscientific research that indicate a positive relationship between attitudinal measures of traditionalism and behavioural and neural marks of control (Weissflog et al., 2013).

The *Orthodox* worldview is associated with the values of self-transcendence and conservation (see, Chapter 3). A defining feature of the *Orthodox* worldview is the emphasis on religion or belief in a higher power/god. It could be argued that the relationship to the values of self-transcendence and conservation may suggest that individuals who endorse this worldview are possibly more exposed to acts of benevolence, through their religious teachings or practices. Furthermore, they also may have a higher tendency to abide by rules and customs because of them being used to surrendering oneself to a higher power. Religiosity has been linked to better inhibitory control abilities (Inzlicht et al., 2009; Weissflog et al., 2013) and for this reason it is expected that the *Orthodox* worldview will be positively linked with inhibitory control.

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It will also be expected that greater inhibitory control will be observed amongst individuals who endorse the *Orthodox* worldview as opposed to all the other worldviews. This will be evidenced by a lower false alarm rate, lower response bias, lower IES, higher hit rate, and higher d' .

The *Pragmatist* worldview is associated with the values of self-enhancement and openness to change (see, Chapter 3). This worldview is characterised by a negative outlook on people and life, largely rooted in selfish motives. Selfish behaviour, which has been described as the inability to overcome self-serving impulses, has been linked to poorer inhibitory control (e.g., Sütterlin et al., 2011). With consideration to this, it is expected that the *Pragmatist* worldview will be negatively linked with inhibitory control as evidenced by a higher false alarm rate, higher response bias, higher IES, lower hit rate, and lower d' .

The *Reward* worldview is associated with the values of self-enhancement and conservation (see, Chapter 3). The central tenant of this worldview is developing and maintaining trustworthy relationships with others, especially those individuals that form part of the ingroup. The link between the *Reward* worldview and self-enhancement reflects the tendency for ingroup over outgroup preference, whereas the link to conservation reflects the desire to implement and abide by rules and norms with the aims of maintaining group peace. As noted earlier, selfishness has been related to poorer inhibitory control (e.g., Sütterlin et al., 2011). Therefore, it is expected that the *Reward* worldview will be negatively linked with inhibitory control as evidenced by a higher false alarm rate, higher response bias, higher IES, lower hit rate, and lower d' .

Lastly, the *Survivor* worldview is associated with the value of conservation and primarily describes a cynical and fatalistic approach to life (see, Chapter 3). Findings have shown that cynicism tends to predict lower self-esteem, lower levels of

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interpersonal trust, and low levels of help-seeking behaviours (Singelis et al., 2003). Coupled with the belief of external locus of control, these characteristics potentially reveal the fragile mental and emotional state of individuals who endorse the *Survivor* worldview. In fact, neuroticism, a trait disposition of mental and emotional instability, has often been found to correlate negatively with measures of executive functioning (e.g., Murdock et al., 2013; Saylik et al., 2018). With consideration to this, it is expected that the *Survivor* worldview will be negatively linked with inhibitory control as evidenced by a higher false alarm rate, higher response bias, higher IES, lower hit rate, and lower d' .

In summary it is hypothesised that:

(S2H1a) The *Orthodox* worldview will be positively linked with inhibitory control; (S2H1b) the *Localised*, (S2H1c) *Pragmatist*, (S2H1d) *Reward*, and (S2H1e) *Survivor* worldviews will be negatively linked with inhibitory control;

(S2H2) Greater inhibitory control will be observed amongst individuals who endorse the *Orthodox* worldview as opposed to all the other worldviews.

4.4 Method

This study followed the methodology outlined in Chapter 2. For a detailed description of the sample and procedure, please refer to Section 2.1.1 and Section 2.1.2.

4.4.1 Measurement Tools

Tasks such as the Go/No-Go task (Eisenberg et al., 2019; Shimony et al., 2021), and working memory span tasks (Eisenberg et al., 2019) have reliably been implemented online. Furthermore, all selected experimental tasks have been used in individual differences research. The selected tasks were: for inhibitory control, the Go/No-Go task (e.g., Amodio et al., 2007; Bender et al., 2016; Tsvetanov et al., 2018; Weissflog et al.,

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2010); and for working memory capacity, the Operation Span Task (e.g., Yu et al., 2014). It is worth noting that only a one task measure for each executive function (inhibitory control, working memory capacity) was used. This was done to reduce any complex demands, given that the participants were in a remote/online environment without direct supervision from the researcher, as opposed to a controlled lab setting. The following will briefly describe the characteristics of each task including the task stimuli, procedure, and dependent variables.

Inhibitory Control

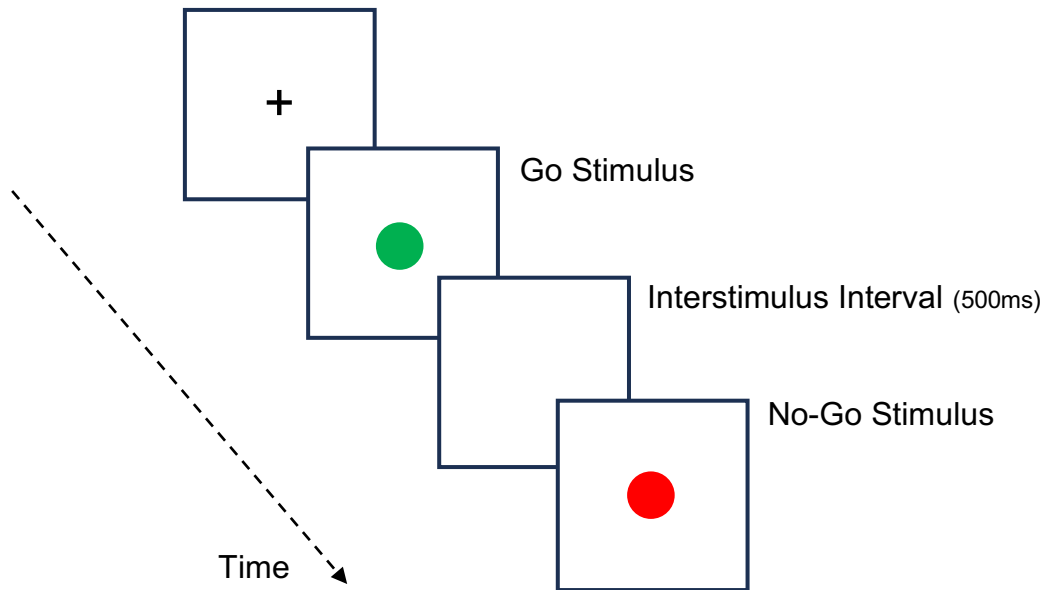
Go/No-Go Task. The Go/No-Go task was adopted from the one used by Amodio et al. (2007) in order to measure prepotent response inhibition. In this task, participants are asked to respond to a set of stimuli that include two different shapes, letters, or colours, one of which is presented as the Go stimulus and the other as the No-Go stimulus (see Figure 3 for illustration). In this study, the Go stimulus was characterised by a green circle whereas the No-Go stimulus was characterised by a red circle. Both stimuli appeared for a maximum of 1000ms on screen. During each trial, participants were instructed to respond as quickly as possible by pressing the space button for the Go-stimulus and to withhold their response for the No-Go stimulus. The majority (85%) of the trials did not include the No-Go stimulus in order to establish a prepotency for a Go response. Each trial lasted no longer than 1500ms. Participants were asked to complete 4 blocks of 40 trials each, totalling 160 trials. This total trial number count was chosen as it has proven to be sufficient to draw out individual differences in other research that also entailed participants completing other experimental tasks (e.g., Bender et al., 2016). Prior to commencing the task, participants were given the opportunity to practice the task to ensure that they have understood the task instruction. Feedback was provided after

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each trial of the practice round. Measures taken during the practice trials and the first trial of each block were excluded from the analyses in order to minimise noise in the data as a result of participants not yet feeling accustomed to the task.

The dependent variables were the Go stimulus reaction time, the proportion of errors during No-Go trials (false alarm rate), the proportion of correct responses during the Go trials (hit rate), d' , response bias, and inverse efficiencies. As outlined by Wickens (2002), d' was calculated by subtracting a z transformation of false alarm rates from a z transformation of hit rates. Z transformations were calculated by taking the inverse of the cumulative distribution (Macmillan & Creelman, 2005). Furthermore, response bias was calculated by summing the z transformation of hit rates with the z transformation of false alarm rates, and then dividing the total by two (representing the two types of correct responses, Go and No-Go) (Macmillan & Creelman, 2005). Lastly, inverse efficiency scores were calculated by dividing the Go-trial reaction time by 1 minus the false alarm rate (Townsend & Ashby, 1983).

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Figure 3*Illustration of the Go/No-Go Task*

Note. For each trial, participants were instructed to respond as quickly as possible by pressing the space button for the Go-stimulus and to withhold their response for the No-Go stimulus. Both stimuli appeared for a maximum duration of 1000ms.

Working Memory

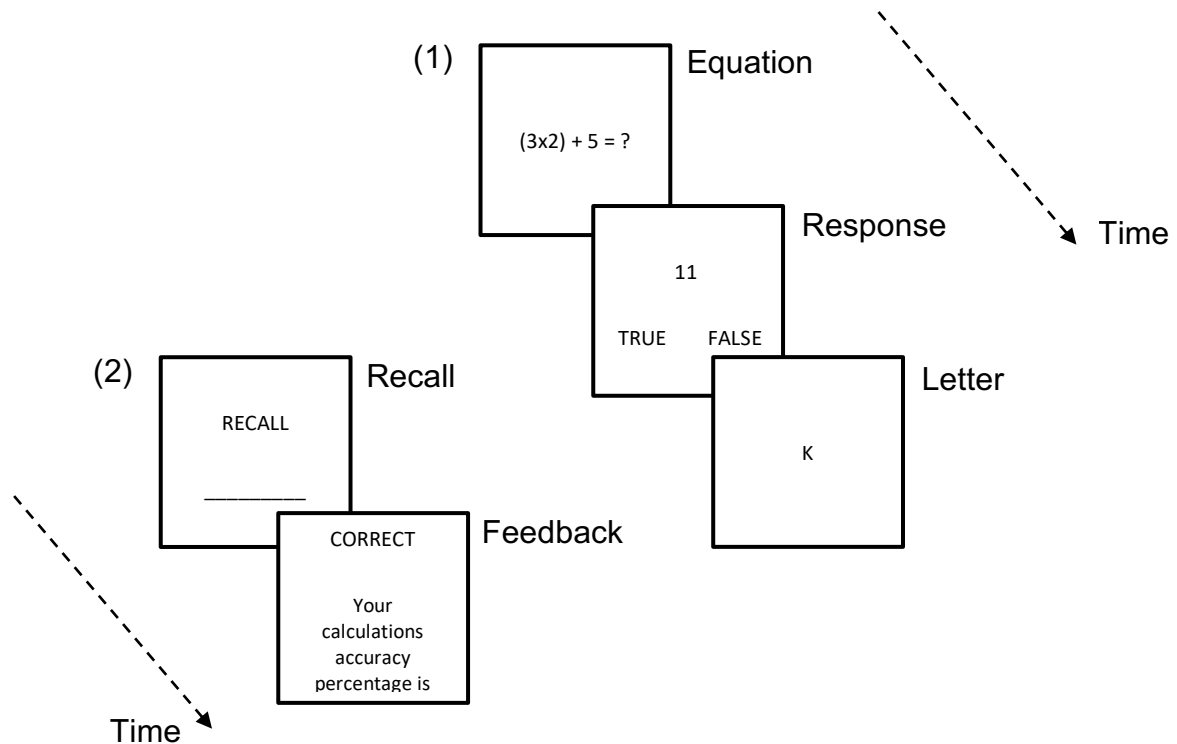
Operation Span Task (OSPAN). This task was adapted from the one originally created by Turner and Engler (1989) as a measure of working memory capacity. This task required participants to verify the accuracy of a series of arithmetic equations while simultaneously remembering a list of words (see Figure 4 for illustration). On each trial, participants were presented with an equation-word combination and asked to indicate whether the equation was correct or incorrect by clicking on the respective button on the screen. The equation lasted 2500ms on screen and participants were allowed up to 3500ms to indicate a response. This time limit was put in place to avoid rehearsal. If no response was given within this time limit, the trial was recorded as incorrect. In addition to this, participants were also required to remember a target letter presented after giving a response to the equation. The target letter lasted 1200ms on screen. This entire sequence

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was repeated using different equation-target letter combinations. Therefore, each trial consisted of a series of equation-target letter combinations ranging from 3 (lowest capacity) to 7 (highest capacity). After a series of equation-target letter combinations, participants were asked to recall all the target letters in the order they had been presented. Participants completed 3 rounds of each series length that were presented in no particular order, thus totalling 15 sets of letters to recall. Participants were provided the opportunity to practice the task prior to commencing the experiment. The practice rounds consisted of a simple span round (letter only recall), arithmetic equation only round, and a combination of both, as takes place in the proper experiment round. Measures taken during the practice rounds were excluded from the analyses.

The dependent variable was the partial span score. The partial span score is favoured over the absolute span score because it is measured by counting the total number of letters recalled in the correct order for any set, regardless of whether the overall span was recalled completely correctly or not (Redick et al., 2012). Typically, the accuracy criterion is adopted for statistical analyses utilising the partial span score. This criterion states that only data from participants with at least 85% accuracy in the mathematical portion of the task should be considered for statistical analyses (Conway et al., 2005). However, in line with recent findings that have shown that this is not necessary (Dokić et al., 2018), this accuracy criterion was discarded for the present analyses.

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Figure 4*Illustration of the OSPAN Task*

Note. The above illustrates the two main stages of the OSPAN task. (1) depicts the first stage which is the presentation of equation-target letter combination. The equation lasted 2500ms on screen and participants were allowed up to 3500ms to indicate a response (true/false). A target letter, that lasted 1200ms on screen, was then displayed. The equation-target letter combination was repeated from a series of 3 times (resulting in a minimum of 3 letters to be recalled), to a series of 7 times (resulting in a maximum of 7 letters to be recalled). After a series of equation-target letter combinations, participants were required to recall the target letters presented, as shown in (2). Feedback as to whether they recalled the target letters correctly or incorrectly, as well the level of accuracy of the equation responses were then displayed.

Worldviews. Worldviews were measured through a scale incorporating a list of 5 distinct vignettes, each of which characterising one of the worldviews. Further detail about this measure may be found in Section 2.1.2 in Chapter 2.

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4.4.2 Data Analyses

Statistical analyses consisted of correlation and regression analyses. Sequential sampling methods such as the drift diffusion model were not suited for the Go/No-Go data as they do not fully capture the decision process, particularly since there is no response recorded for successful No-Go trials (Ratcliff, 1978; Ratcliff & McKoon, 2008). For the regression analyses, dummy variables were created for each worldview. Notably, since there is empirical evidence linking the *Orthodox* worldview to conservative attitudes (Sammot et al., 2022), it was selected as the reference category for all the models. To control for the known influence of working memory on tasks of executive function (McCabe et al., 2010), all analyses entailed a two-block hierarchical model in which the measure of working memory capacity (i.e., the partial span score) was included in the first block, and the dummy coded worldviews were included in the second block. Further to hierarchical regression analyses, linear mixed-effect modelling to investigate trial-by-trial performance was also carried out.

4.5 Results

When asked to select the single worldview that best approximated their own, the majority chose the *Localised* worldview (45.4%), followed by *Pragmatist* (24.7%), *Reward* (13.1%), *Orthodox* (8.8%), and lastly, *Survivor* (8.0%). When asked to rate the extent of their agreement with each individual worldview, the *Localised* worldview received the highest rating ($M = 4.08$, $SD = .79$) whereas the *Survivor* worldview received the lowest rating ($M = 2.60$, $SD = 1.17$).

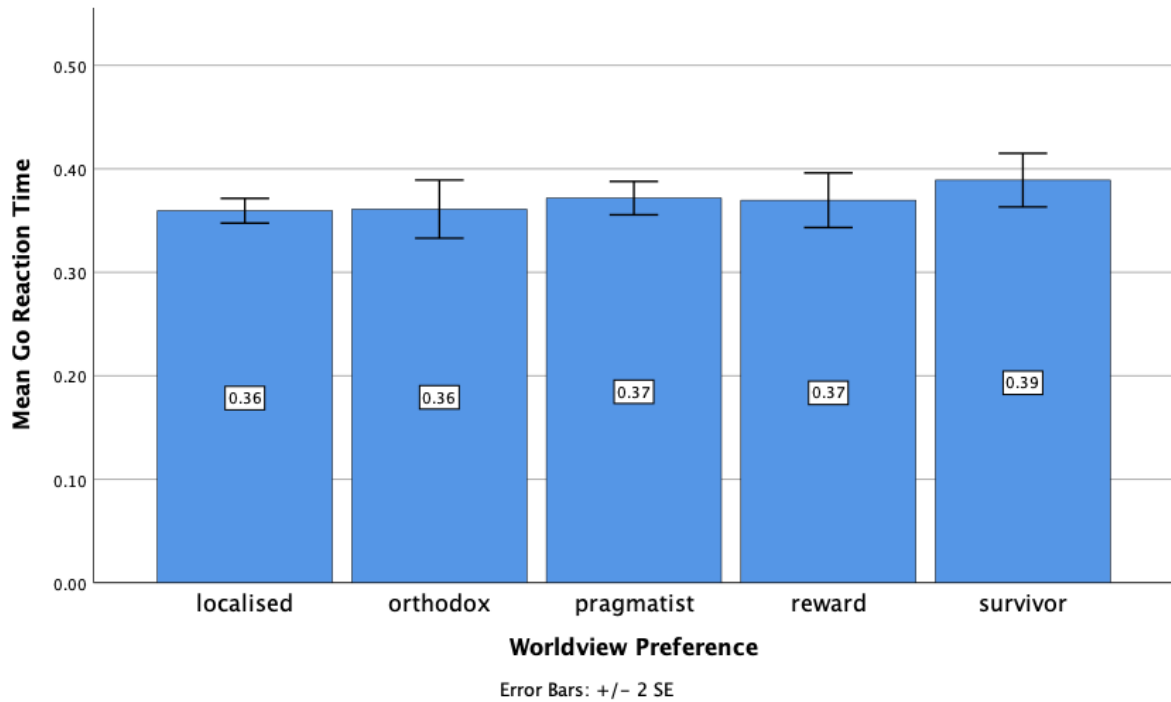
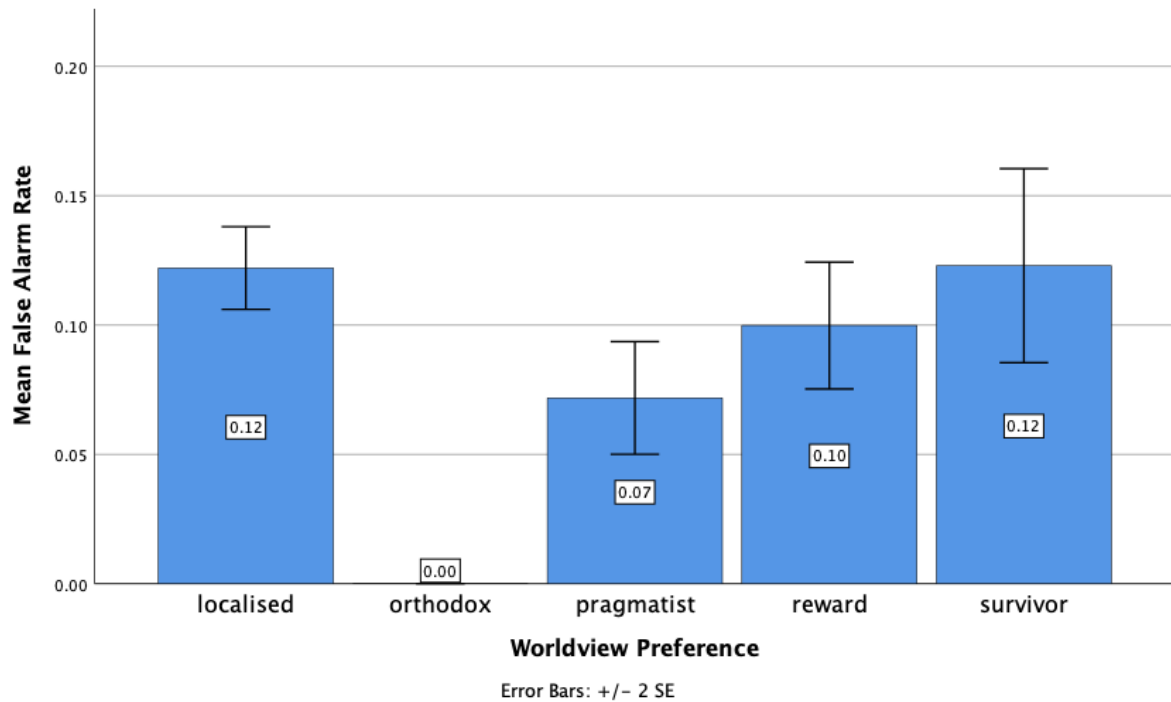
The total number of missed trials across all participants during the Go/No-Go task was 61 (0.19%), these were excluded from further analysis. On average, the fastest

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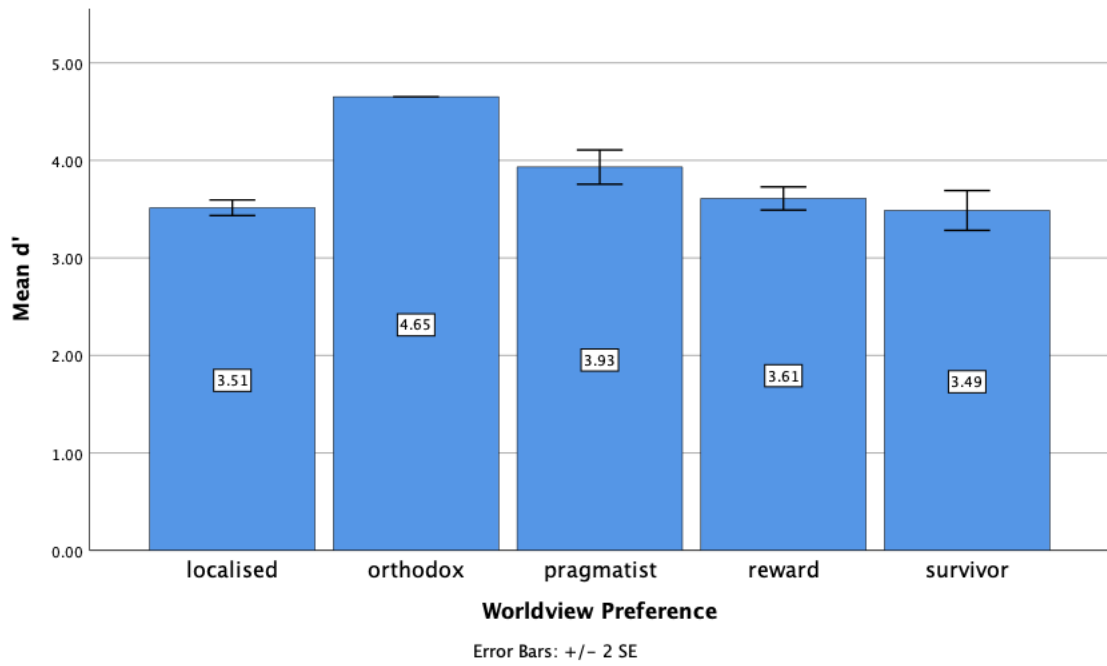
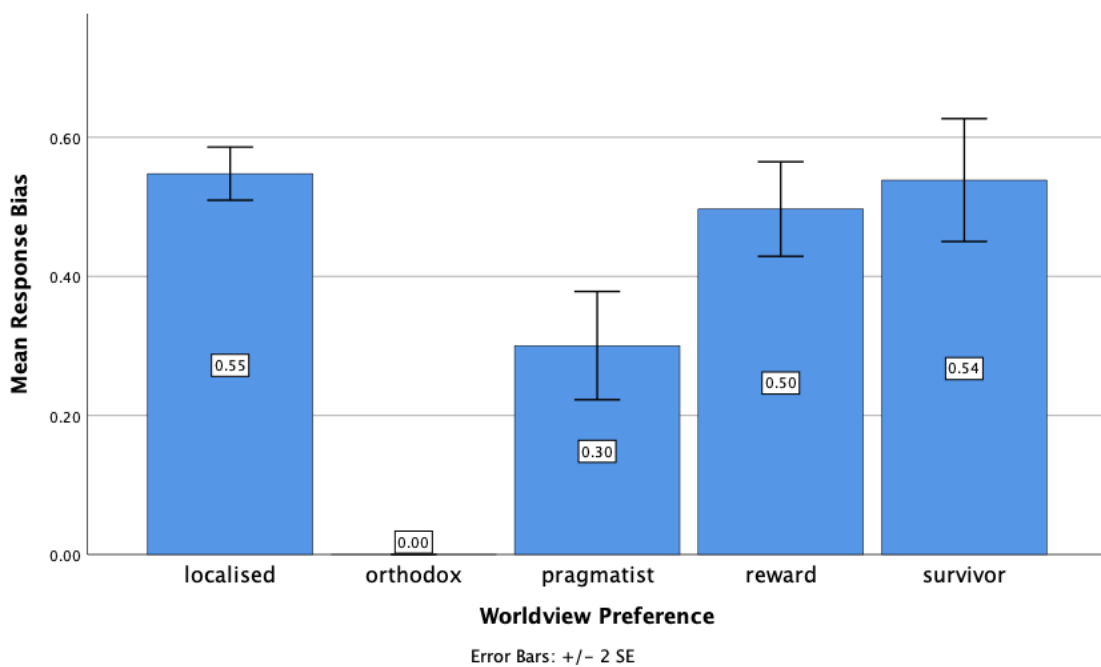
reaction time during Go trials was 240ms whereas the slowest average reaction time during Go trials was 690ms. Moreover, on average the false alarm rate was .10 ($SD = .07$), indicating that participants mistakenly gave a response in 10% of No-Go trials. For a report of the full descriptives, see Tables C.1A and C.1B, and Figures C.1-C.2 in Appendix C.

Those holding an *Orthodox* worldview tended to have the lowest inverse efficiency score (i.e., fastest reaction time, measured in seconds, when factoring in accuracy) ($M = .37$, $SD = .07$), whereas those holding a *Survivor* worldview tended to have the highest inverse efficiency score (i.e., slowest reaction time, measured in seconds, when factoring in accuracy) ($M = .40$, $SD = .06$). Moreover, those holding a *Survivor* worldview tended to have the highest number of false alarm rates ($M = .12$, $SD = .08$), along with those holding a *Localised* worldview ($M = .12$, $SD = .09$). Those holding a *Survivor* worldview also tended to have the lowest d' ($M = 3.49$, $SD = .46$). In contrast, those holding an *Orthodox* worldview tended to have the lowest number of false alarm rates ($M = .00$, $SD = .00$) and highest d' ($M = 4.65$, $SD = .00$). For an illustration of the mean Go reaction times, false alarm rates, d' , and response biases during the Go/No-Go task, see Figures 5a-d.

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Figure 5a*Mean Reaction Times in Go Trials during the Go/No-Go Task Grouped by Worldview***Figure 5b***Mean Proportion of Errors (False Alarm Rate) During the Go/No-Go Task Grouped by Worldview*

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Figure 5c*Mean d' values During the Go/No-Go Task Grouped by Worldview***Figure 5d***Mean Response Bias During the Go/No-Go Task Grouped by Worldview*

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4.5.1 Correlations between Inhibitory Control Measures and Worldviews

The p-values reported in this section have been Bonferroni corrected to mitigate the risk of Type 1 errors arising from multiple comparisons. The *Survivor* worldview was the only worldview to correlate with measures of the Go/No-Go task (see, Table 5). Specifically, there was a weak negative correlation between the *Survivor* worldview and reaction time, $r = .20, p = .006, 95\% \text{ CI } [0.08, 0.32]$, and between the *Survivor* worldview and the inverse efficiency score (IES), $r = .20, p = .012, 95\% \text{ CI } [0.08, 0.32]$. These results provide some evidence for a negative correlation between the *Survivor* worldview and inhibitory control, thus, partly confirming S2H1e respectively. Since no significant correlations emerged for the *Localised*, *Orthodox*, *Pragmatist*, and *Reward* worldviews, S2H1a, S2H1b, S2H1c, and S2H1d are rejected.

Table 5*Correlations Between Measures of the Go/No-Go Task and Worldviews*

Variable	1	2	3	4	5	6	7	8	9	10	11
1. RT	-										
2. False Alarm Rate	-.037	-									
3. Hit Rate	-.209*	-.109	-								
4. d'	-.054	-.912**	.312**	-							
5. Response Bias	-.052	.918**	.070	-.921**	-						
6. IES	.996**	-.037	-.239*	-.059	-.059	-					
7. Localised	.050	.122	-.025	-.138	.153	-.045	-				
8. Pragmatist	.053	.046	-.097	.521	.957	.052	.058	-			
9. Orthodox	.083	-.112	.013	.018	.018	.092	.226**	.057	-		
10. Reward	-.102	.142	.129	.185	.137	-.101	.186**	-.055	.292**	-	
11. Survivor	.202**	-.062	-.079	.511	.248	.197*	-.066	.204**	.084	-.005	-
<i>M</i>	.366	.096	.999	3.73	.431	.372	4.08	3.72	3.42	2.89	2.60
<i>SD</i>	.065	.087	.006	.585	.279	.065	.794	.985	1.026	1.220	1.174

* $p < .05$. ** $p < .01$

4.5.2 Regression Analyses

A series of hierarchical regression models, with each measure of the Go/No-Go task as the dependent variable, was carried out. Notably, the first block of the model included the partial OSPAN score, as a measure of working memory capacity, whereas the second block included all the dummy-coded worldviews. As outlined earlier, the *Orthodox* worldview was the reference category for all measures of the Go/No-Go task. In addition to this, linear mixed-effect modelling for trial-by-trial reaction time was carried out.

The models predicting reaction time (including linear mixed-effect modelling for trial-by-trial reaction time), hit rate, and inverse efficiency score (IES) were not significant, so they were excluded from further analyses. The model predicting false alarm rate was significant, $R^2 = .177$, $F(5, 245) = 10.561$, $p < .001$, such that the worldviews alone contributed to 17.7% of the variance. All other worldviews predicted significantly higher false alarm rates than the *Orthodox* worldview. Specifically, the *Localised* worldview, $\beta = .123$, $t(245) = 6.615$, $p < .001$, 95% CI [0.09, 0.16], the *Pragmatist* worldview, $\beta = .072$, $t(245) = 3.627$, $p < .001$, 95% CI [0.03, 0.11], the *Reward* worldview, $\beta = .100$, $t(245) = 4.559$, $p < .001$, 95% CI [0.06, 0.14], and the *Survivor* worldview, $\beta = .123$, $t(245) = 5.012$, $p < .001$, 95% CI [0.08, 0.17], predicted a higher false alarm rate.

The model predicting d' was significant, $R^2 = .332$, $F(5, 245) = 24.340$, $p < .001$, such that the worldviews alone contributed to 33.2% of the variance. All other worldviews predicted a significantly lower d' score than the *Orthodox* worldview. The *Localised* worldview, $\beta = -1.146$, $t(245) = -10.158$, $p < .001$, 95% CI [-1.37, -0.92], the *Pragmatist* worldview, $\beta = -.722$, $t(245) = -6.023$, $p < .001$, 95% CI [-.96, -0.49], the

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Reward worldview, $\beta = -1.045$, $t(245) = -7.855$, $p = .001$, 95% CI [-1.31, -0.78], and the *Survivor* worldview, $\beta = -1.169$, $t(245) = -7.832$, $p < .001$, 95% CI [-1.46, -0.88], predicted lower accuracies, as evidenced through d' .

The model predicting response bias was significant, $R^2 = .365$, $F(5, 245) = 28.219$, $p < .001$, such that the worldviews alone contributed to 36.5% of the variance. Relative to the *Orthodox* worldview, the *Localised* worldview, $\beta = .551$, $t(245) = 10.514$, $p < .001$, 95% CI [0.45, 0.65], the *Reward* worldview, $\beta = .497$, $t(245) = 8.050$, $p < .001$, 95% CI [0.38, 0.62], the *Pragmatist* worldview, $\beta = .301$, $t(245) = 5.400$, $p < .001$, 95% CI [0.19, 0.41], and the *Survivor* worldview, $\beta = .540$, $t(245) = 7.783$, $p < .001$, 95% CI [0.40, 0.68], predicted a higher tendency to respond.

Since the *Orthodox* worldview has demonstrated significantly better performance during the Go/No-Go task (as evidenced through false alarm rate, d' , and response bias), therefore, predicting better inhibitory control, S2H2 is supported.

4.6 Discussion

This second study investigated the relationship between inhibitory control and worldviews. Behavioural tasks, aimed at measuring inhibitory control (Go/No-Go task) and working memory capacity (OSPAN), were administered along with self-report measures of worldviews. Correlational analysis, a series of hierarchical linear regression, and linear mixed-model analyses were carried out. The correlational analyses captured differences within worldviews (i.e., differences between high and low scores of each worldview), whereas the regression analyses captured differences between worldviews. Results revealed significant correlations for the *Survivor* worldview. The *Survivor* worldview correlated positively with inverse efficiency score during the Go/No-Go task,

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indicating that the longer one takes to give a correct response during this task, the greater the endorsement of the *Survivor* worldview,

Further to the correlations, results also revealed significant differences between the worldviews. Higher false alarm rates and lower d' scores were observed amongst those holding an *Orthodox* worldview when compared to all other worldviews. Therefore, as predicted, those who demonstrated the best inhibitory control abilities during the Go/No-Go task were more likely to endorse the *Orthodox* worldview.

In summary, some meaningful relationships have been uncovered, namely, (1) those holding an *Orthodox* worldview demonstrated superior inhibitory control abilities during the Go/No-Go task, and (2) slower and more thoughtful performance during the Go/No-Go task is associated with greater endorsement of the *Survivor* worldview.

4.6.1 Worldviews and Inhibitory Control

Findings from this second study have confirmed some of the predictions and offer new insights. Notably, executive functions, that were investigated in the form of inhibitory control, have been shown to explain key behavioural differences within and between worldviews.

The hypotheses negatively linking the *Localised* worldview to inhibitory control have been supported. The correlation analysis revealed no significant relationship between the *Localised* worldview and inhibitory control, however, the regression analysis revealed that the *Localised* worldview is linked with significantly poorer inhibitory control than the *Orthodox* worldview. Findings from Study 1 (Chapter 3) showed that the *Localised* worldview is empirically linked to the values of self-transcendence and openness to change. It could be argued that the negative link to inhibitory control might result in the habit of rejecting the status quo. Earlier it was stated

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that individuals with better inhibitory control do not tend to deviate from the norm. It is possible that the *Localised* worldview is negatively linked to inhibitory control because individuals who endorse such a worldview are largely independent, preferring to pave their own path, and set their own norms. For this reason, such individuals might not be used to constant self-monitoring, an aspect that crucially allows individuals to compare and adjust their behaviour in line with the codes of society (e.g., Figueira & Garcia-Marques, 2019).

The hypotheses negatively linking the *Pragmatist* worldview to inhibitory control have been partly supported. The correlation analysis revealed no significant relationship between the *Pragmatist* worldview and inhibitory control, however, the regression analysis revealed that the *Pragmatist* worldview demonstrated poorer inhibitory control than the *Orthodox* worldview. Findings from Study 1 (Chapter 3) showed that the *Pragmatist* worldview is empirically linked to the values of self-enhancement and openness to change. The finding negatively linking this worldview to inhibitory control suggests that adopting a selfish approach to life may be related to impulsive behaviour. This is in line with research that has shown the importance of self-control for successful prosocial interactions where, notably, lack of self-control has been found to promote unethical behaviour (Gino et al., 2011).

The hypotheses positively linking the *Orthodox* worldview to inhibitory control have been partly supported. The correlation analysis revealed no significant relationship between the *Orthodox* worldview and inhibitory control, however, the regression analysis revealed that all other worldviews demonstrated significantly poorer inhibitory control abilities when compared to the *Orthodox* worldview. Findings from Study 1 (Chapter 3) showed that the *Orthodox* worldview is empirically related to the values of self-transcendence and conservation. As noted earlier, the defining characteristics of this

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worldview is religiosity and conservativeness. It was previously argued that, since religiosity has been linked to better inhibitory control but poorer cognitive flexibility (e.g., Inzlicht et al., 2009; Weissflog et al., 2010, 2013; Zmigrod et al., 2019b), the *Orthodox* worldview will also display the same relationships. Notably, the present study has corroborated findings on the relationship with inhibitory control. It is possible that the *Orthodox* worldview is linked to better inhibitory control because of a tendency to engage self-control in day-to-day life, an aspect that is typically observed amongst conservatives or religious individuals (Buechner et al., 2020; Clarkson et al., 2015).

The hypotheses negatively linking the *Reward* worldview to inhibitory control have been supported. The regression analysis revealed that the *Reward* worldview is related to significantly poorer inhibitory control abilities when compared to the *Orthodox* worldview. Findings from Study 1 (Chapter 3) showed that the *Reward* worldview is empirically related to the values of self-enhancement and conservation, and largely describes the desire to build alliances, maintain the status quo, and strive for achievement. Present findings confirm the possibility that such a combination of values and beliefs are linked with poorer inhibitory control.

Finally, the hypotheses negatively linking the *Survivor* worldview to inhibitory control have been partly supported. Findings revealed differences between high and low scorers of the *Survivor* worldview, such that higher endorsers of this worldview displayed poorer inhibitory control. Furthermore, regression analyses revealed that the *Survivor* worldview is associated with poorer inhibitory control abilities. Findings from Study 1 (Chapter 3) showed that the *Survivor* worldview is empirically linked to the value of self-enhancement and conservation and largely describes a fatalistic approach to life. Fatalism has been shown to share a negative relationship with the processes involved in the early stages of response monitoring by attenuating the reaction to errors (Rigoni et al., 2015).

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It has also been linked to poorer effort to exert self-control and overcome automatic thinking and behaviour (Baumeister et al., 2009). For this reason, it could be said that the present findings add to the body of research linking beliefs on free will with inhibitory control. Fatalism is synonymous to the concept of locus of control (Lefcourt, 2014), therefore, it is possible that inhibitory control plays a significant role in predicting locus of control (or fatalism).

4.7 Conclusion

This second study has demonstrated that inhibitory control ability may predispose individuals to endorse a certain worldview over another. Most notably was the finding that individuals with greater inhibitory control are more likely to endorse an *Orthodox* worldview than any of the other worldviews. Earlier it was noted that only a single task measure was implemented per executive function (inhibitory control, working memory capacity). Moreover, since prepotent response inhibition has shown considerable face validity when compared to the other two inhibitory control functions (resistance to distractor interference and resistance to proactive interference) (Friedman & Miyake, 2004; Nigg, 2000), it was selected as the inhibitory control function of focus in this study. Despite not investigating the other two inhibitory control functions, I believe that there is potential that the present findings may be replicated when choosing tasks aimed at measuring the other inhibitory functions. Primarily, all these functions share common underlying processes (Friedman & Miyake, 2004). In addition, there is empirical evidence linking tasks aimed at measuring them (e.g., Eriksen Flanker task for resistance to distractor interference, and cued recall tasks for resistance to proactive interference) to tasks measuring prepotent response inhibition (e.g., Go/No-Go) (Friedman & Miyake, 2004; Gärtner & Strobel, 2021).

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The scope of the next study (Chapter 5) is to determine whether differences between worldviews may also be observed when considering another executive function, cognitive flexibility. Despite drawing upon similar resources, inhibitory control and cognitive flexibility refer to distinct abilities (Miyake et al., 2000). Whilst inhibitory control is concerned with resolving interference, cognitive flexibility is concerned with both resolving interference as well as updating and shifting (Miyake et al., 2000). Considering the already established relationship between executive functions and self-regulation (see, Nigg, 2017), this second study, and the one to follow in Chapter 5, may prove to be valuable in informing ways on how self-regulation failures in day-to-day life can be minimised or avoided by detailing the situations in which different belief types are most suited to engage in better self-regulation.

Chapter 5

Study 3

Individual Differences in Cognitive Flexibility: Investigating the Relationship between Task Switching Ability and Worldviews

The aim of this study is to investigate the relationship between worldviews and cognitive flexibility. The notion of worldviews was conceptualised by Sammut et al. (2022) in order to offer a novel five-factor typology aimed at unifying the related concepts of symbolic universes (Salvatore et al., 2018), social axioms (Leung & Bond, 2009), moral foundations (Haidt, 2012) and deep stories (Hochschild, 2016). The five worldview typologies proposed include the *Localised*, *Orthodox*, *Reward*, *Pragmatist*, and *Survivor* worldviews (Sammut et al., 2022). The *Localised* worldview involves the desire to fix problems or address social issues. The *Orthodox* worldview seeks to preserve the status quo. The *Reward* worldview centres around determination to work hard to obtain a desired goal. The *Pragmatist* worldview is protective and revolves around self-interest. Lastly, the *Survivor* worldview involves fatalism and distrust in others (Sammut, 2019; Sammut et al., 2022). A more detailed review of worldviews may be found in Chapters 1 and 3.

5.1 Cognitive Flexibility

Cognitive flexibility describes the ability to adapt to new and unexpected changes in the environment (Dajani & Uddin, 2015). The contribution of cognitive flexibility to self-regulation lies in the ability to switch back and forth between different means that

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subserve the self-regulatory goal (Hofmann et al., 2012). Along with inhibitory control and working memory, it is considered one of the main processes of executive function (Miyake et al., 2000). Predominantly, within the literature on executive function, cognitive flexibility is discussed in the context of processes requiring shifting or switching; including set shifting and task switching (Dajani & Uddin, 2015; Ionescu, 2012). On the one hand, set shifting refers to a lower-level cognitive flexibility requiring individuals to shift between different cognitive sets or rules. It essentially entails changing one's mental strategy in line with changing instructions and is typically measured with tasks such as the Wisconsin Card Sorting Task (WCST; Berg, 1948) (Dajani & Uddin, 2015). On the other hand, task switching can be seen as a form of attentional shifting, requiring the ability of shifting the focus of attention by disengaging and reorienting it from one task or stimulus to another, without the need to change one's mental strategy. In contrast to set shifting, it describes a higher-level cognitive flexibility and is typically measured with tasks such as the Letter-Digit Classification task (Rogers & Monsell, 1995) (Bunge & Zelazo, 2006; Dajani & Uddin, 2015). Both set shifting and task switching result in "switch costs", referred to as the slowing down of response time and decrease in accuracy. For set shifting, this is thought to arise due to the time taken to reconfigure one's mental strategy to the new task, whereas for task switching this arises due to the time taken to inhibit the response of previous rules and respond accordingly with the new rule (Badre & Wagner, 2006; Berg, 1948; Rogers & Monsell, 1995). In this study, I will be adopting the same conceptualisation of cognitive flexibility as Rogers and Monsell (1995) and Miyake et al. (2000), who view cognitive flexibility as switching "back and forth between multiple tasks, operations, or mental sets" (Miyake et al., 2000, p. 55). Consequently, this study will focus on cognitive flexibility as measured through task switching ability. Task switching has been proposed to comprise of two separate

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stages (Rogers & Monsell, 1995; Rubinstein et al., 2001). One stage is named the goal-reconfiguration stage or executive control processes stage and comes into effect as soon as participants are cued about the task at hand (Rogers & Monsell, 1995; Rubinstein et al., 2001). This stage constitutes encoding the stimulus, identifying the appropriate response, and executing the correct movement to provide this response (Rubinstein et al., 2001). Conversely, the other stage is named the rule-activation stage or task processes stage and comes into effect when the target stimulus is presented (Rogers & Monsell, 1995; Rubinstein et al., 2001). This stage entails the ability to keep track of current and future tasks and updating the contents of working memory accordingly (e.g., when shifting from a letter classification to a digit classification). In the present study, the Letter/Digit Classification Task (Rogers & Monsell, 1995) will be selected as a measure of task switching ability. In this task, participants are presented with pairs of letters and digits and, based on where they appear, must quickly and accurately classify each item as either a vowel/consonant (letter classification) or odd/even (number classification). Importantly, the classification required may change between trials. The measures of interest in this task are the difference in reaction times between single classification trials and mixed classification trials (switch cost), the proportion of errors during switches in mixed trials, the proportion of errors during no-switches in mixed trials, sensitivity between signal and noise during mixed trials (d'), response bias, and reaction time factoring in accuracy (inverse efficiencies) during both switches and no switches in mixed trials.

In summary, the underlying premise is that cognitive flexibility surpasses inhibitory control in terms of complexity because of the need to continuously update working memory. This may explain why certain individuals who excel in inhibitory control may not necessarily excel in cognitive flexibility (e.g., Inzlicht et al., 2009;

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Weissflog et al., 2013). In addition to investigating individual differences in cognitive flexibility in terms of task switching ability, this study also aims to provide evidence for such differences between inhibitory control and cognitive flexibility within the context of worldviews.

5.2 Hypotheses

The overall objective of this third study is to assess whether differences in cognitive flexibility are associated with different worldviews. Studies have shown that cognitive flexibility may be associated with certain beliefs or ideologies (Buechner et al., 2020; Zmigrod et al., 2019a). Using an American sample, Singelis et al. (2003) found that *social complexity*, one of five dimensions of the Social Axioms Survey (Leung & Bond, 2009) correlated positively with self-reports of cognitive flexibility. In a study investigating the relationship between cognitive inflexibility and ideological thinking, Zmigrod et al. (2019a) reported that cognitive inflexibility (as measured by performance using the WCST) predicted right-wing extremist attitudes, including the endorsement of violence to protect ingroup members and harm outgroup members. In another study investigating the relationship between political ideology and executive functioning, Buechner et al. (2020) reported a correlation between cognitive flexibility, in terms of political orientation, and response inhibition and working memory. Particularly, conservatives demonstrated a better ability in tasks requiring inhibition, whereas liberals demonstrated a better ability in tasks that require updating (Buechner et al., 2020). The present study will build on these findings by investigating the relationship between cognitive flexibility and worldviews.

The *Localised* worldview is associated with the values of self-transcendence and openness to change (see Study 1, Chapter 3). A central theme characterising this

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worldview is the notion of care and tolerance towards others. Studies have reported that individuals with prosocial and altruistic preferences are more likely to possess flexible socio-cognitive skills (e.g., Yelpeze et al., 2020). Additionally, *social complexity*, a social axiom conceptually similar to the *Localised* worldview, has been linked to better cognitive flexibility (Singelis et al., 2003). Openness to change itself has also been linked to higher cognitive flexibility (Brosch et al., 2010; Jost et al., 2003). In line with these findings, it will be expected that the *Localised* worldview will be positively linked with cognitive flexibility. Moreover, it will also be expected that the greater cognitive flexibility will be observed amongst individuals who endorse the *Localised* worldview when compared to those who endorse the *Orthodox*, *Reward*, or *Survivor* worldviews. This will be evidenced by a higher hit rate, higher d' , lower false alarm rate, lower global switch cost, lower local switch cost, and lower inverse efficiency score (IES).

The *Orthodox* worldview is associated with the values of self-transcendence and conservation (see Study 1, Chapter 3). A defining feature of the *Orthodox* worldview is the emphasis on traditionalism. The combination of such values suggests that those who endorse the *Orthodox* worldview may be more likely to abide by traditionalist thinking and practices. Beliefs that emphasise traditionalism have been linked to poorer cognitive flexibility (Zmigrod et al., 2018) and for this reason it will be expected that the *Orthodox* worldview will be negatively linked with cognitive flexibility. This will be evidenced by a lower hit rate, lower d' , higher false alarm rate, higher global switch cost, higher local switch cost, and higher IES.

The *Pragmatist* worldview is associated with the values of self-enhancement and openness to change (see Study 1, Chapter 3). The link between the *Pragmatist* worldview and openness to change may be explained by the notion that individuals who endorse this worldview are relatively distrustful of people and society in general, consequently, being

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less willing to act within the constraints imposed by others. Openness to change has been linked to higher cognitive flexibility (Brosch et al., 2010; Jost et al., 2003) and for this reason, it will be expected that the *Pragmatist* worldview will be positively linked with cognitive flexibility. It will also be expected that the greater cognitive flexibility will be observed amongst individuals who endorse the *Pragmatist* worldview when compared to those who endorse the *Orthodox*, *Reward*, or *Survivor* worldviews. This will be evidenced by a higher hit rate, higher d' , lower false alarm rate, lower global switch cost, lower local switch cost, and lower IES.

The *Reward* worldview is associated with the values of self-enhancement and conservation (see Study 1, Chapter 3). The link between the *Reward* worldview and conservation reflects the desire to implement and abide by rules and norms with the aim of maintaining group peace. Conservatism is related to poorer cognitive flexibility (Buechner et al., 2020; Zmigrod et al., 2019b). Therefore, it will be expected that the *Reward* worldview will be negatively linked with cognitive flexibility. This will be evidenced by a lower hit rate, lower d' , higher false alarm rate, higher global switch cost, higher local switch cost, and higher IES.

Lastly, the *Survivor* worldview is associated with the value of conservation and primarily describes a cynical and fatalistic approach to life (see Study 1, Chapter 3). Conservatism is linked to poorer cognitive flexibility (Buechner et al., 2020; Zmigrod et al., 2019b). Furthermore, findings have also shown that cynicism tends to be linked to lower self-esteem, lower levels of interpersonal trust, and low levels of help-seeking behaviours (Singelis et al., 2003), variables that all have been indirectly negatively correlated with measures of executive function (e.g., Murdock et al., 2013; Saylik et al., 2018). For this reason, it will be expected that the *Survivor* worldview will be negatively linked with cognitive flexibility. This will be evidenced by a lower hit rate, lower d' ,

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higher false alarm rate, higher global switch cost, higher local switch cost, and higher IES.

In summary it is hypothesised that:

(S3H1a) The *Localised* and (S3H1b) *Pragmatist* worldviews will be positively linked with cognitive flexibility; (S3H1c) the *Orthodox*, (S3H1d) *Reward*, and (S3H1e) *Survivor* worldviews will be negatively linked with cognitive flexibility;

Greater cognitive flexibility will be observed amongst individuals who endorse (S3H2a) the *Localised* and; (S3H2b) *Pragmatist* worldviews when compared to those who endorse the *Orthodox*, *Reward*, or *Survivor* worldviews.

5.3 Method

This study followed the methodology outlined in Chapter 2. For a detailed description of the sample and procedure, please refer to Section 2.1.1 and Section 2.1.2.

5.3.1 Measurement Tools

Cognitive Flexibility

The Letter-Digit Classification Task. The letter-digit classification task was adapted from the one created by Rogers and Monsell (1995) as a measure of how easily individuals can switch between two different tasks. Part of the Python and JavaScript code for this task was acquired from Morys-Carter and Mifsud (2022). The stimuli consisted of letters and numbers. In each trial participants were presented with a number and letter pair and, based on their location on screen, were instructed to make either a consonant/vowel classification of letters or an odd/even classification of digits as quickly as possible without compromising accuracy (see, Figure 6). The letters chosen were A, E, I, U for the vowels, and D, G, H, F for consonants. Conversely, the numbers chosen

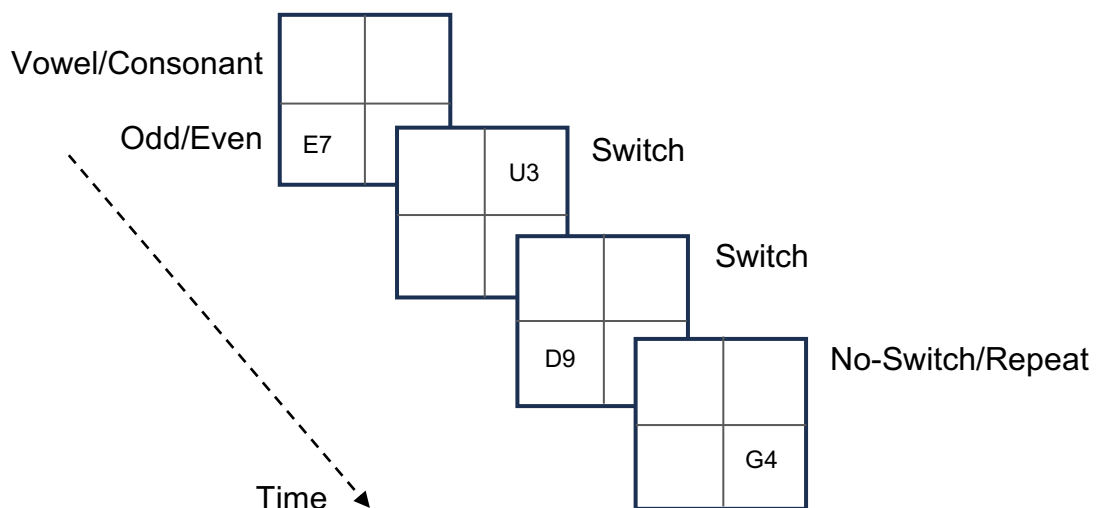
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were 2, 4, 6, 8 for even numbers and 3, 5, 7, 9 for odd numbers. On a given trial only a single task was performed (letter classification or digit classification); if the letter-digit combination appeared in the top-half of the screen participants were required to carry out a letter classification, whereas if it appeared in the bottom-half of the screen participants were required to carry out a digit classification. Following the method used by Rogers and Monsell (1995), 4 blocks of 48 trials each were performed. Each trial lasted the duration that participants took to make a response. The first block consisted of a single classification task where the first set of 24 trials solely entailed a letter classification (i.e., the letter-digit pair always appeared in the top-half of the screen), and the second set of 24 trials solely entailed a digit classification (i.e., the letter-digit pair always appeared in the bottom-half of the screen). The remaining 3 blocks consisted of an interleaved mix of letter and digit classification trials (mixed trials). Each of the 3 blocks had an equal number of switch and non-switch trials, letter classification, and digit classification. Participants were given the opportunity to practice both the single classification tasks and the mixed classification tasks before commencing with the experiment. Feedback was provided after each trial of the practice rounds to ensure that participants have understood the task instructions. Measures taken during the practice trials and the first trial of each block were excluded from the analyses in order to minimise noise in the data as a result of participants not yet accustomed to the task.

The dependent variables were response times, the proportion of errors during mixed trials (error rate), the proportion of correct responses during mixed trials (hit rate), d' during mixed trials, global switch costs, local switch costs, and the inverse efficiency score during mixed trials. As noted earlier, d' was calculated by subtracting a z transformation false alarm rates from a z transformation of hit rates. Moreover, Z transformations were calculated by taking the inverse of the cumulative distribution

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(Macmillan & Creelman, 2005). Global switch costs were calculated by subtracting the mean reaction time and error rate on non-switch trials from the mean reaction time and error rate on mixed trials (Rogers & Monsell, 1995). Local switch costs were calculated by taking the difference in the mean reaction time and error rate between switch and non-switch instances during the mixed block (Rogers & Monsell, 1995; Wylie & Allport, 2000). The inverse efficiencies score for mixed trials was calculated by dividing the reaction time by 1 minus the proportion of errors during mixed classification trials.

Figure 6*Illustration of the Letter-Digit Classification Task*

Note. For each trial, participants were instructed to respond as quickly as possible by pressing the key that corresponded to the correct classification (e.g., left key for vowels and even numbers, right key for consonants and odd number). A letter classification was required when the letter-digit pair appeared in the top half of the screen, whereas a digit classification was required when the letter-digit appeared in the bottom half of the screen. The letter-digit pair remained on screen until a response was given. Once a response was provided, the following trial began. As illustrated in the above example, the following trial could either be a switch in the classification exercise (switch trial) or it could be a repeat of the previous classification exercise (no-switch/repeat trial).

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Working Memory. Working memory was measured through performance in the Operation Span Task (OSPAN). Further detail about this may be found in Section 4.4.1 in Chapter 4.

Worldviews. Worldviews were measured through a scale incorporating a list of 5 distinct vignettes, each of which characterising one of the worldviews (see, Appendix B.1). Further detail about this measure may be found in Section 2.1.2 in Chapter 2.

5.3.2 Data Analyses

Statistical analyses consisted of correlation and regression analyses. For the regression analyses, dummy variables were created for each worldview. Since the *Localised* worldview is the most common worldview that participants identify with, it was selected as the reference category for all the models (Darlington et al., 2016). To control for the known influence of working memory on tasks of executive function (McCabe et al., 2010), all analyses entailed a two-block hierarchical model in which the measure of working memory capacity (i.e., the partial span score) was included in the first block, and the dummy coded worldviews were included in the second block. Further to hierarchical regression analyses, linear mixed-effect modelling to investigate trial-by-trial performance was also carried out.

5.4 Results

The number of missed trials across all participants during the Letter/Digit Classification task was 178 (0.50%), these were excluded from further analyses. Notably, the data pertaining to two participants was removed from the analyses for having the mean reaction time greater than 4 standard deviations from the mean. Overall, reaction

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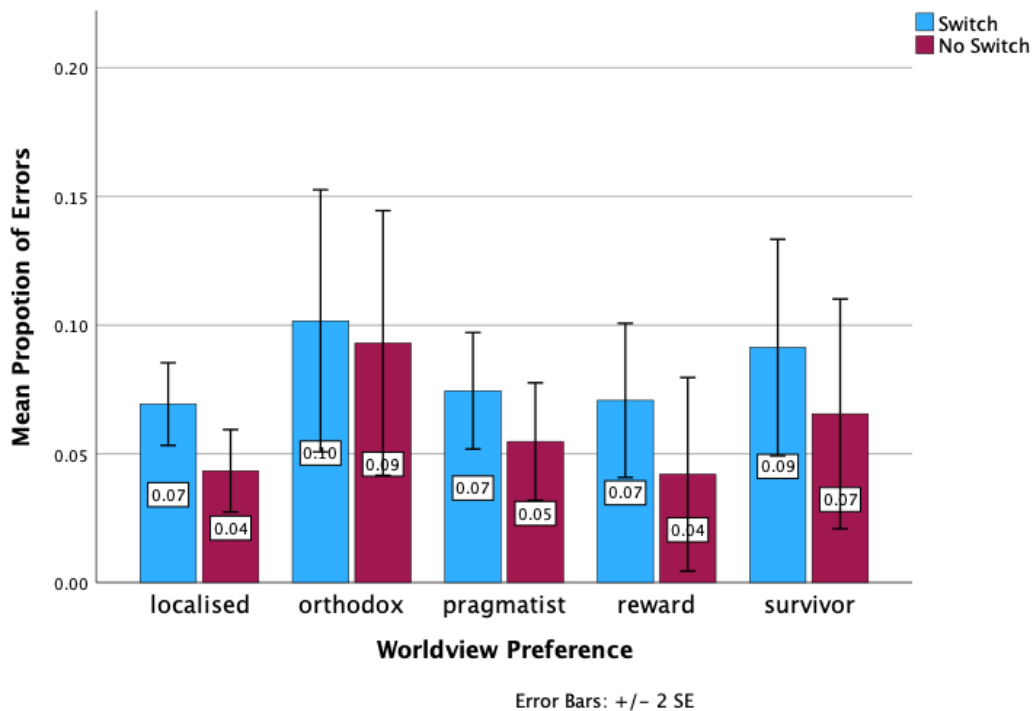
times (measured in seconds) were significantly slower during a switch ($M = 1.59$, $SD = .57$) when compared to non-switch trials ($M = 1.13$, $SD = .39$), $t(248) = 20.70$, $p < .001$, 95% CI [0.41, 0.50], regardless of the worldview one endorsed. Furthermore, error rates were significantly higher during a switch ($M = .08$, $SD = .09$) when compared to non-switch trials ($M = .05$, $SD = .09$), $t(248) = 8.44$, $p < .001$, 95% CI [0.02, 0.03]. This validates the scope of the task as it provides evidence for poorer performance during a switch when compared to a non-switch (for a report of the full descriptive data, see Tables C.2a and C.2b, and Figures C.2-C.6 in Appendix C).

With reference to the worldviews, the *Localised* worldview tended to have the fastest average reaction time when factoring in accuracy during mixed trials ($M = 1.41$, $SD = .43$), whereas the *Reward* worldview tended to have the slowest average reaction time when factoring in accuracy during mixed trials ($M = 1.78$, $SD = 1.05$). The *Localised* worldview tended to the lowest number of error rates ($M = .06$, $SD = .08$), whereas the *Orthodox* worldview tended to have the highest number of error rates ($M = .10$, $SD = .12$). The *Orthodox* worldview also tended to have the lowest global ($M = .51$, $SD = .30$) and local ($M = .31$, $SD = .33$) switch costs, contrasting the *Reward* worldview, which tended to have the highest global switch cost ($M = .82$, $SD = 1.07$), and the *Pragmatist* worldview which tended to have the highest local switch cost ($M = .62$, $SD = 1.44$), and. For illustration of the proportion of errors during switch and no switch trials, and the mean reaction time during switch and no switch trials, grouped by worldviews, see Figures 7a and 7b, respectively.

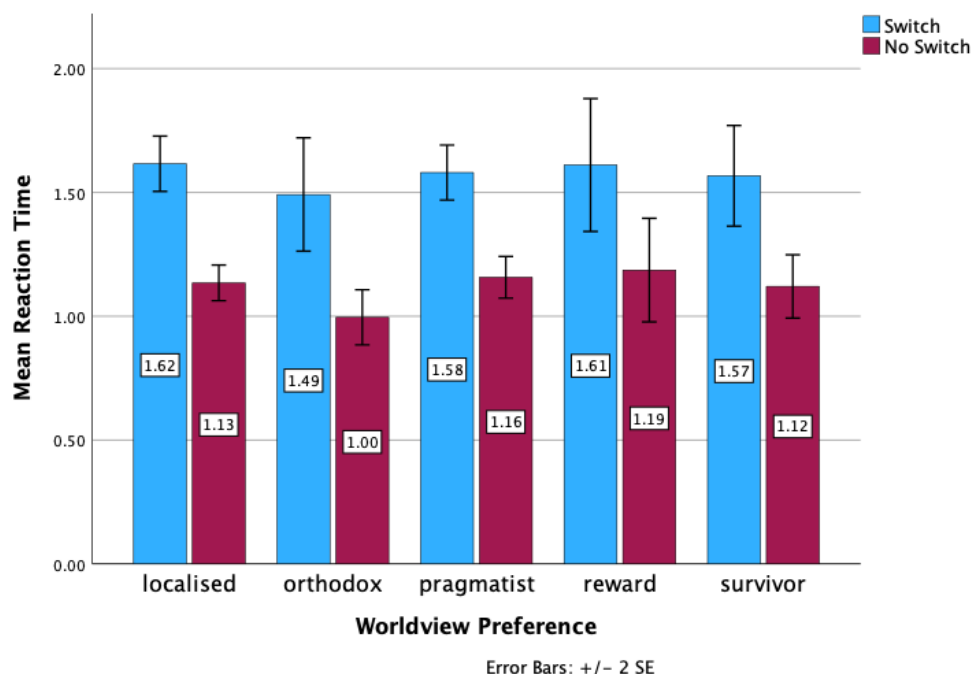
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Figure 7a

Mean Proportion of Errors (Error Rate) in the Letter-Digit Classification Task Grouped by Worldviews

**Figure 7b**

Mean Reaction Time for Switch and No Switch Trials in the Letter/Digit Classification Task Grouped by Worldviews



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5.4.1 Correlations between Cognitive Flexibility Measures and Worldviews

The *Pragmatist* and the *Survivor* worldviews correlated with measures of the Letter-Digit Classification task, particularly, there was a weak positive correlation for both with local switch cost, $r = .13$, $p = .05$, 95% CI [0.00, 0.25], and $r = .14$, $p = .03$, 95% CI [0.02, 0.26], respectively. However, once p-values were Bonferroni corrected, the results revealed no significant correlations. For this reason, S3H3a-S3H3e are rejected.

5.4.2 Regression Analyses

A series of hierarchical regression models, with each measure of the Letter-Digit Classification task as the dependent variable, was carried out. Notably, the first block of the model included the partial OSPAN score, as a measure of working memory capacity, whereas the second block included all the dummy-coded worldviews. As outlined earlier, the *Localised* worldview was the reference category for all measures of the Letter-Digit Classification task. Moreover, linear mixed-effect modelling for trial-by-trial reaction time was carried out.

The models predicting reaction time during a switch (including linear mixed-effect modelling for trial-by-trial reaction time), error rate, hit rate, d' , global switch cost, local switch costs, and inverse efficiency score were not significant, so they were excluded from further analyses. It is worth noting that even when not controlling for working memory capacity (i.e., omitting the partial OSPAN score from the first block) no significant findings emerged. Since the analysis to determine whether greater cognitive flexibility is observed amongst those who endorse the *Localised* or *Pragmatist* worldviews was inconclusive, the hypotheses S3H2a and S3H2b are rejected.

5.5 Discussion

This third study investigated the relationship between cognitive flexibility and worldviews. Behavioural tasks, aimed at measuring cognitive flexibility (Letter-Digit Classification task) and working memory capacity (OSPAN), were administered along with self-report measures of worldviews. Correlational analysis, a series of hierarchical linear regression, and linear mixed-model analyses were carried out. The correlational analyses captured no differences within worldviews (i.e., differences between high and low scores of each worldview), whereas the regression analyses captured no differences between worldviews. Overall, the findings were largely insignificant such that no differences in cognitive flexibility emerged between the worldviews.

In Chapter 1 it was discussed that the go-to measures and statistical methods for analysing performance in behavioural tasks have sometimes proved to be insufficient in detecting individual and group differences, thus, resulting in weak correlations between behavioural data and self-report data (see, Dang et al., 2020). This may explain why little to no significant findings emerged from this third study. With consideration to this, I felt it essential to seek alternate methods of statistical analyses to ensure a robust investigation and determine whether the current conclusions arose as a result of the statistical analyses or because they are truly not present. In contemporary literature, successful attempts have been made in using computational models. Notably, one such model that has been taking centre stage in individual differences is the drift diffusion model (DDM) (e.g., Pleskac et al., 2019; Ratcliff et al., 2010; Ratcliff et al., 2016; Schubert et al., 2019). Unlike other cognitive models, such as signal detection, the DDM does not assume a static process of evidence accumulation and, for this reason, may prove to be a valuable model for social and personality research as it provides a more

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sophisticated approach for detecting underlying latent variables. Owing to this, the DDM was selected as an additional method of analyses for investigating the relationship between cognitive flexibility and worldviews.

5.6 An Introduction to the Drift Diffusion Model

The diffusion model is a sequential sampling model originally developed in the 1970s by Roger Ratcliff, with the aim of modelling the cognitive processes that are implicated in two-choice decision tasks (Ratcliff, 1978; Ratcliff & McKoon, 2008). Using accuracy and response time data, it conceptualises the decision process as an accumulation of evidence over time that eventually crosses one of two boundaries, stops, and then executing the response that corresponds to the selected boundary (Ratcliff & McKoon, 2008). An assumption of this model is that, across time, the brain is accumulating evidence from the stimulus (drift) whilst simultaneously combatting noise (diffusion) (Ratcliff & McKoon, 2008). A clear benefit of this model is that it can extract separate distinguishable parameters or estimates that have to do with such a decision process, namely, response bias, threshold, drift rate, and non-decision time.

The starting point of the decision process, also referred to as the response bias, is termed z . This parameter reflects the prepotent bias towards a particular decision, therefore, affecting the starting point of the drift process (Ratcliff & McKoon, 2008; Voss et al., 2004). The decision boundary separation, also known as threshold, is termed a . This represents the separation between the upper and lower boundaries and influences how much evidence needs to be accumulated before executing a response (Ratcliff & McKoon, 2008; Voss et al., 2004). Essentially, it quantifies the speed-accuracy trade-off, such that high values indicate a preference towards accuracy over speed, whereas a low value indicates a preference towards speed over accuracy (Ratcliff & McKoon, 2008;

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Voss et al., 2004). With consideration to the switching task implemented in this study, it is thought that the greater the difference in threshold between switch and no switch conditions, the more adaptable one is in adjusting their need for evidence in response to shifting task demands. Conversely, the lower the difference in threshold between switches and no switches, the more rigid and cautious one is in adjusting their need for evidence in response to shifting task demands. The rate of evidence accumulation, also referred to as the drift rate, is termed v . This parameter concerns the efficiency with which one accumulates evidence to make a decision, where high values indicate fast and accurate decision and low values indicate slow and error-prone decisions (Ratcliff & McKoon, 2008; Voss et al., 2004). It could also be regarded as a measure of task difficulty wherein easier tasks result in higher drift rates (values further away from zero) (Ratcliff & McKoon, 2008; Voss et al., 2004). With consideration to the switching task implemented in this study, it is thought that the greater the difference in drift rates between switch and no switch conditions, the more sensitive one is to shifting task demands. Conversely, the lower the difference in drift rates between switch and no switch conditions, the more consistent one is in response to shifting task demands. The final parameter, non-decision time, is termed t , and represents anything that does not have to do with the decision-making process. More specifically, it is defined as the time needed to encode the stimulus ($t_{encoding}$) summed with the time needed to execute the response ($t_{response}$) (Ratcliff & McKoon, 2008; Voss et al., 2004). With consideration to the switching task implemented in this study, it is thought that the lower the differences in non-decision time between switch and no switch conditions, the lower the time cost in processing efficiency and response execution in response to shifting task demands. It is worth noting that the drift diffusion model may be extended to extract further parameters that take into consideration inter and intra trial variability (Ratcliff & McKoon, 2008),

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however, for the sake of this study, the focus will be on the threshold, drift rate, and non-decision time parameters.

The diffusion model has become increasingly influential within a range of fields, including memory research (e.g., Criss, 2010; Ratcliff et al., 2016), decision making (e.g., Pleskac et al., 2019), clinical studies (e.g., Moustafa et al., 2015), and even economics (e.g., Clithero, 2018). Ratcliff et al. (2016) offer three explanations for its success. Firstly, the model allows for the reconciliation of speed and accuracy information, and for this reason, it can be applied to a range of behavioural data. Secondly, explicit links have been established between neural models and diffusion models. For instance, drift diffusion model parameters have been shown to be implicated in several cortical regions and the basal ganglia (see, Gupta et al., 2022). Furthermore, it is now also possible to computationally predict neural activity from DDM parameters and vice versa (see, O'Connell et al., 2018). Thirdly and lastly, since it has been applied across various domains of psychology, it has encouraged novel interpretations of data. There is no doubt that the DDM is capable of capturing information that may otherwise be left undiscovered with traditional measures of performance (e.g., speed-accuracy trade-offs). Over the years, the use of the DDM has become increasingly popular in cognitive science, however, this popularity has only now started to reach the domain of individual differences, social, and personality research. Particularly, to date, most of the literature on DDM concerns the investigation of perceptual decision-making (e.g., Tavares et al., 2017) and value-based choice (e.g., Krajbich & Rangel, 2011; Maier et al., 2020; Milosavljevic et al., 2010). Studies exploring individual and group differences are few. Notably, these studies have shown that the DDM may detect the contribution of cognitive processes within contexts where traditional self-report measures or behavioural measures (i.e., the commonly adopted measures within this domain of research) are not nuanced

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enough. For instance, in a study investigating race-categorisation using diffusion model analysis, Benton and Skinner (2015) reported that race categorisation differences are driven by differences in perceptual sensitivity towards race-defining physical characteristics. In another study investigating how hierarchical DDM can be applied to social psychology research, Johnson et al. (2017) showed how DDM parameters offer novel insights into theoretical accounts of racial influences. Particularly, they reported race-based differences in the decision to shoot, as uncovered by the drift rate DDM parameter. In the same study, Johnson et al. (2017) investigated how hierarchical DDM can be applied to personality research. By extracting DDM parameters during the flash gambling task (Zeigenfuse et al., 2014), the authors provided insight into the deliberation process during risk decision-making, and how this may be correlated to substance abuse behaviour. Several other studies have correlated the efficiency of information accumulation (drift rate, v) with general intelligence, IQ, and age (e.g., Lerche et al., 2020; Ratcliff et al., 2010; Schulz-Zhecheva et al., 2016). Despite the ever-growing interest in applying the DDM to individual differences, and social and personality research, a select few studies have attempted to relate DDM parameters to self-report measures (e.g., Hall et al., 2021; Hedge et al., 2020; Johnson et al., 2017; Zmigrod et al., 2021), and some of these have reported little to no significant relationships (Hedge et al., 2020; Johnson et al., 2017). Nonetheless, the notion that DDM parameters, particularly drift rate, have the potential to reflect trait-like properties of cognitive processes (i.e., they are stable across time and across different conditions) (see, Schubert et al., 2016) is deemed a valid reason for applying DDM to the focus of investigation in this study, that is, to worldviews.

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5.6.1 Bayesian Hierarchical Modelling

The models that have been typically developed to understand and describe neural, cognitive, and behavioural processes in cognitive science centre around the assumption that parameter estimates are accurate in characterising individual subjects. Single subject maximum likelihood estimation is a popular method used to separately estimate parameters for each individual subject (Palestro et al., 2018). This, along with other approaches, that rely on the same underlying assumption, have been criticised because of their lack of reliability that may arise out of the tendency of capturing noise rather than stable individual characteristics (Katahira, 2016). Hierarchical modelling is an alternative that has been proposed to address such issues (Katahira, 2016; Nilsson et al., 2011). Hierarchical DDMs produce parameters estimates at the individual level and condition level (experimental manipulation or individual/group differences). It is governed by the assumption that participants within each group are similar, but not identical, to one another (Nilsson et al., 2011). For this reason, the hierarchical model is constructed in a way that individual-level parameters are constrained by group-level parameters, that is, it uses group-level estimation to inform individual level estimation (Nilsson et al., 2011). In doing so, hierarchical models prove be more robust methods of analysis of individual differences when compared to their non-hierarchical counterparts that tend to produce grand estimates collapsed across participants and trials (Katahira, 2016; Nilsson et al., 2011).

A common method for estimating parameters in hierarchical models entails utilizing a Bayesian approach (Wiecki et al., 2013). Adopting this approach means incorporating prior beliefs (distributions) about the parameters in the overall analysis. This is done by specifying a probability distribution for each parameter. These prior distributions are then updated to posterior distributions when taking into consideration

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the observed data. Notably, the posterior distributions reflect the degree of certainty associated with the parameters, therefore, allowing for probabilistic inference about the parameters given prior knowledge and the observed data (Wiecki et al., 2013). The posterior distribution is notoriously high-dimensional and complex, however, a useful approach to navigate it is through the Markov Chain Monte Carlo (MCMC) method, a numerical method that draws a large sample from the posterior distribution enabling easier statistical computation (Chernozhukov & Hong, 2003). In summary, Bayesian hierarchical DDM is useful for simultaneously fitting individual-level parameters and group-level distribution, and for this reason will be the chosen method of analyses for the current study.

5.7 Updated Hypotheses

Earlier it was expected that the *Localised* worldview would be positively linked with cognitive flexibility. Particularly, greater cognitive flexibility was expected to be observed amongst those endorsing a *Localised* worldview when compared to those endorsing an *Orthodox*, *Reward*, or *Survivor* worldview. This hypothesis will remain and will be evidenced by a smaller difference in drift rate and a larger difference in threshold between switch and no switch conditions amongst those with a *Localised* worldview when compared to those with an *Orthodox*, *Reward*, or *Survivor* worldview.

The *Orthodox* worldview was expected to be negatively linked with cognitive flexibility. This hypothesis will remain however, it will now also be expected that, in line with the literature linking religiosity and cognitive inflexibility, the worst cognitive flexibility will be observed amongst those with an *Orthodox* worldview when compared to all other worldviews. Notably, this is expected to be the case even when comparing the *Orthodox* worldview to the other worldviews (*Reward* and *Survivor*) that are similarly

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linked to the value of conservation (Study 1, Chapter 3). This will be evidenced by a greater difference in drift rate and smaller difference in threshold between switch and no switch conditions amongst those with an *Orthodox* worldview when compared to all the other worldviews.

The *Pragmatist* worldview was expected to be positively linked to cognitive flexibility. Correlational analyses revealed the contrary. Nonetheless, since the regression analyses revealed no significant findings, the hypothesis that better cognitive flexibility will be observed amongst those endorsing a *Pragmatist* worldview when compared to those endorsing an *Orthodox*, *Reward*, or *Survivor* worldview will remain. This will be evidenced by a smaller difference in drift rate and a greater difference in threshold between switch and no switch conditions amongst those with a *Pragmatist* worldview when compared to those with an *Orthodox*, *Reward*, or *Survivor* worldview.

The *Reward* worldview was expected to be negatively linked with cognitive flexibility. This hypothesis will remain and will be evidenced by a greater difference in drift rate and a smaller difference in threshold between switch and no switch conditions amongst those with a *Reward* worldview when compared to those with a *Localised* or *Pragmatist* worldview.

Lastly, the *Survivor* worldview was expected to be negatively linked with cognitive flexibility. This hypothesis will remain and will be evidenced by a greater difference in drift rate and smaller difference in threshold between switch and no switch conditions amongst those with a *Survivor* worldview when compared to those with a *Localised* or *Pragmatist* worldview.

In summary, it is hypothesised that:

The *Localised* and *Pragmatist* worldviews will have smaller differences in drift rates (S3H3a and S3H3b, respectively) and greater difference in threshold (S3H3c and

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S3H3d, respectively) when compared to the worldviews that value conservation, that is, the *Orthodox*, *Reward*, and *Survivor* worldviews.

The *Orthodox* worldview will struggle the most with the switching task, having the greatest differences in drift rate (S3H4a) and smallest difference in threshold (S3H4b) when compared to all other worldviews.

5.8 Data Analyses: Drift Diffusion Model

The aim of this study was to investigate individual differences in cognitive flexibility. For this reason, the analyses were primarily concerned with performances during switch trials (i.e., trials that entail a different sort of categorisation than the trial before it) and whether such performances differed amongst those with different worldviews. Analyses were carried out using HDDM (version 0.9.7), a popular open-source Python toolbox that allows a relatively straight-forward approach to the formation and statistical analysis of hierarchical Bayesian drift diffusion models (Wiecki et al., 2013). Data pertaining to the mixed trials for every participant were entered in the analyses. No outlier values were omitted, as the DDM is robust in handling variations in the data (Ratcliff, 1993). The default, non-informative prior approach was selected to ensure that the results were primarily driven by the observed data (Matzke & Wagenmakers, 2009; Wiecki et al., 2013). A total of eight different models were fit to the data, these are outlined in the following:

Model 1. In the first model, it was assumed that the estimated parameters (drift rate, threshold, non-decision time, bias) did not vary by trial type or worldview.

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Model 2. In the second model, it was assumed that the estimated parameters (drift rate, threshold, non-decision time, bias) only vary by trial type (switch, non-switch). This model served to validate the task (i.e., to ensure that poorer performance is observed during switches when compared to non-switches).

Model 3. In the third model, it was assumed that the estimated parameters (drift rate, threshold, non-decision time, bias) varied by worldview (*Localised, Orthodox, Pragmatist, Reward, Survivor*) regardless of trial type.

The purpose of Models 1-3 was to carry out model comparisons in order to determine the best fitting model. This entailed extracting and comparing the deviance information criterion (DIC) of these models, where lower DIC values indicate a better fit (Spiegelhalter et al., 2002). The DIC is known to be biased in selecting models with greater complexity (e.g., Hsu et al., 2015), however, despite this, it is still a useful metric for determining model fit (Wiecki et al., 2013). The DIC revealed that Model 2 (DIC: 54020.581340) was a better fit to the data when compared to Model 1 (DIC = 63063.99) and Model 3 (DIC = 63064.07). This indicates that the model considering trial type (switch/non-switch) achieved a better trade-off between goodness-of-fit and model complexity. For this reason, the remainder of the models, outlined in the following, were based on Model 2.

Models 4-8. In the fourth to eight models, it was assumed that the estimated parameters (drift rate, threshold, non-decision time, bias) only vary by trial type (switch, non-switch). Notably, the data used for each model was dependent on which participants identified with which worldview (model 4 - *Localised*; model 5 - *Orthodox*; model 6 -

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Pragmatist; model - 7 *Reward*, model 8 - *Survivor*). Once the data was divided based on the worldview that a participant identified with, a within-subject analysis in each respective model was implemented to extract the posterior distribution of the different parameters during a switch. After all models were fitted to the data of each individual corresponding to their respective worldview, an average across the individual parameters within each model was then calculated resulting in aggregated group (worldview) parameters. Bayesian pairwise comparison was then carried out to examine possible worldview differences in the aggregated parameters during a switch.

Since HDDM uses MCMC to draw posterior samples it is important to ensure that all sampled values had properly converged (Wiecki et al., 2013). A total of 5,000 samples were drawn, discarding the first 300 samples as burn in (see, Wiecki et al., 2013). Following this, two methods of analyses were carried out to test convergence. The first method entailed a visual inspection of the traces, autocorrelations, and the marginal posteriors. Traces that have converged resemble a “fuzzy caterpillar”, autocorrelations are as flat and close to 0 as possible, and the histograms are as close to a normal distribution as possible (Wiecki et al., 2013). The second method, which is considered a more formal method of assessment, entailed computing the Gelman-Rubin statistic (\hat{r}) for every parameter estimated. To compute this, five chains of 1,000 samples each were drawn. All \hat{r} values were below 1.1, indicating convergence (Brooks & Gelman, 1998). Furthermore, all traces, autocorrelations, and marginal posterior distributions satisfied the visual inspection checks. In addition to the assessment of convergence, posterior predictive checks (PPCs) were also performed to evaluate whether the simulated data reproduced the observed data well. A total of 500 response time distributions were simulated for all models. All models reproduced mean response times accurately for both

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the upper and lower boundaries, indicating that all models are adequate in describing the real observed data. It is worth noting, however, that simulated standard deviation values for the upper boundaries were inaccurate for all models. Nevertheless, considering the simulated mean response times were accurate, and sampled values successful converged, the models were deemed satisfactory for analyses (see, Appendix C).

Analyses entailed comparing the posterior of each averaged parameter for the different models. The main comparisons of interest were the difference in parameter estimates between all worldviews (i.e., Models 4-8). For this, Bayesian significance testing within HDDM was carried out that analysed the probability of the posterior distribution of a particular parameter of one worldview being larger or smaller than another (note, the resulting P is similar but not equivalent to the frequentist p) (Wiecki et al., 2013). Convention rules of thumb for interpreting probability values in Bayesian significance testing are that: probability values less than .50 indicate no evidence, probability values between .50 and .75 indicate weak evidence, probability values between .75 and .95 indicate positive evidence, and, lastly, probability values between .95 and 1.00 indicate strong evidence (Jeffreys, 1961).

5.9 Results: Drift Diffusion Model

Analyses on Model 2 revealed that all parameter estimates differed between switch and non-switch conditions regardless of the worldview that one endorsed. The drift rate was weaker during switches when compared to non-switches ($M_{\text{diff}} = -.502$, $SD_{\text{diff}} = .034$), $P = 1.0$, providing strong evidence that the task was perceived to be more difficult during switches. The threshold was smaller during switches when compared to non-switches ($M_{\text{diff}} = .201$, $SD_{\text{diff}} = .025$), $P = 1.0$, providing strong indication that there was less evidence accumulation and greater error-proneness during switches. Non-

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decision time (measured in seconds) was greater for switches when compared to non-switches ($M_{\text{diff}} = .176$, $SD_{\text{diff}} = .006$), $P = 1.0$, providing strong evidence that during switches less time was spent on stimulus encoding and executing a response. In summary, there was strong evidence for a weaker drift rate, smaller threshold, and faster non-decision time during switches when compared to non-switches.

Analyses on Model 4-8 revealed that for all worldviews all parameter estimates differed between switch and non-switch conditions (see Table 6 for summary of differences between switch and non-switch conditions). Particularly, for each worldview, the drift rate was weaker during switches, when compared to non-switches, $P = 1.0$, providing strong evidence that the task was perceived to be more difficult during switches. For the *Localised*, *Pragmatist*, and *Reward* worldviews there was strong evidence for a greater threshold during switches when compared to non-switches, $P = 1.0$. Moreover, for the *Orthodox* and *Survivor* worldviews there was positive evidence for a greater threshold during switches when compared to non-switches, $P = 0.75$ and $P = 0.79$, respectively. Overall, this suggests that there was greater evidence accumulation during switches. Lastly, for each worldview, non-decision time was greater for switches when compared to non-switches, $P = 1.0$, providing strong evidence that during switches more time was spent on stimulus encoding, motor movements, response execution, and other process not relating to the decision itself. In summary, there is evidence for a weaker drift rate, greater threshold, and greater non-decision time during switches when compared to non-switches.

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Table 6

The Differences in Drift Rate, Threshold, and Non-Decision Time between Switch and Non-Switch Conditions for Each Worldview

	v		a		t	
	M_{diff}	SD_{diff}	M_{diff}	SD_{diff}	M_{diff}	SD_{diff}
Localised	-.483	.027	.283	.030	.169	.006
Orthodox	-.613	.064	.075	.073	.229	.013
Pragmatist	-.470	.036	.195	.049	.182	.009
Reward	-.529	.045	.142	.063	.122	.018
Survivor	-.517	.066	.090	.091	.198	.016

5.9.1 Drift Rate: The Rate of Evidence Accumulation

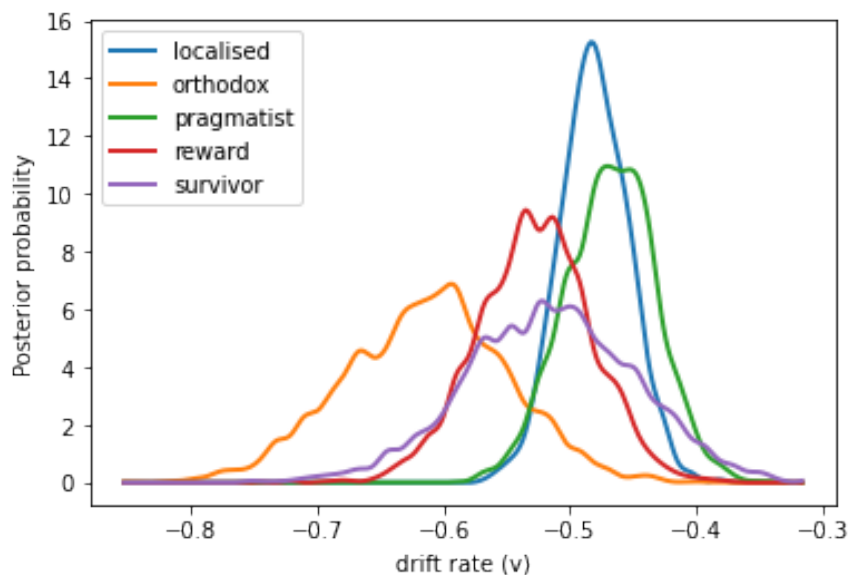
As stated in Section 5.8, this analysis was only concerned with performance comparing switches to no switches. Those holding a *Localised* or *Pragmatist* worldview tended to have the lowest difference in drift rates between switch and no switch conditions out of all the worldviews (see, Figure 8). Conversely, those holding an *Orthodox* worldview tended to have the greatest difference in drift rates between switch and no switch conditions out of all the worldviews. Partly, as predicted in S3H3a, those holding a *Localised* worldview demonstrated a greater difference in drift rates between switch and no switch conditions than the other worldviews. There was strong evidence for this when compared to those holding an *Orthodox* worldview, $P = 0.97$, positive evidence when compared to those holding a *Reward* worldview, $P = 0.82$, and weak evidence when compared to those holding a *Survivor* worldview, $P = 0.68$. Furthermore, partly as predicted in S3H3b, those holding a *Pragmatist* worldview demonstrated a greater difference in drift rates between switch and no switch conditions than other worldviews. There was strong evidence for this when compared to those holding an

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Orthodox worldview, $P = 0.98$, positive evidence when compared to those holding a *Reward* worldview, $P = 0.74$, and weak evidence when compared to those holding a *Survivor* worldview, $P = 0.68$. There is no evidence for any differences in drift rates between those holding a *Localised* or *Pragmatist* worldview. Besides demonstrating a greater difference in drift rates between switch and no switch conditions, when compared to those holding a *Localised* or *Pragmatist* worldviews, there was also positive evidence for a greater difference in drift rates between switch and no switch conditions for those holding an *Orthodox* worldview when compared to those holding a *Reward*, $P = 0.87$ or *Survivor* worldview, $P = 0.86$. For this reason, there is positive to strong evidence for accepting S3H4a.

Figure 8

Posteriors of Drift Rate Estimates for all Worldviews During a Switch



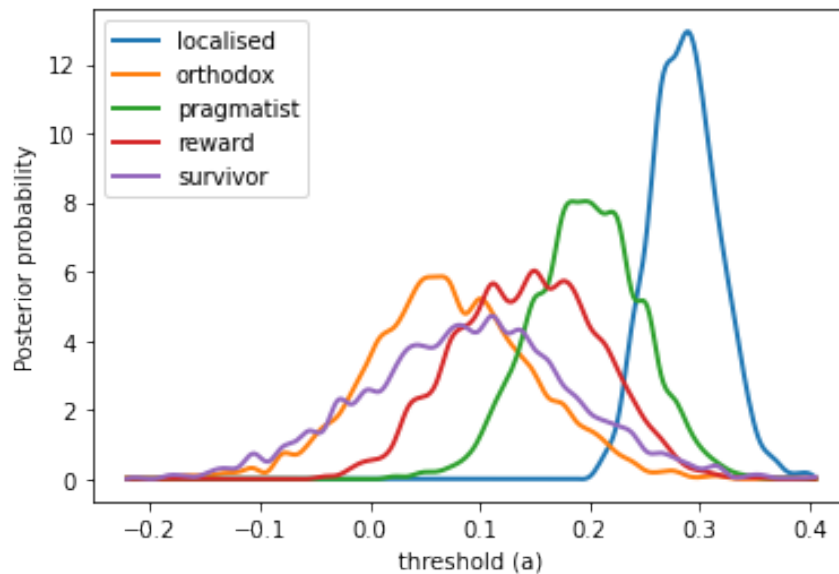
Note. This graph depicts the likelihood of different values of the drift rate (for each worldview) given the data and models used. Smaller differences in drift rates for the *Localised* and *Pragmatist* worldviews suggest that individuals who endorse either of these two worldviews tended to experience smaller negative changes in their performance between switches and no switches when compared to individuals who endorse the *Orthodox*, *Reward*, or *Survivor* worldviews.

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5.9.2 Threshold: Amount of Evidence Required

Considering the differences between switch and no switch conditions, those holding a *Localised* worldview tended to have the greatest difference in threshold out of all the worldviews (see, Figure 9). Conversely, those holding an *Orthodox* or *Survivor* worldview tended to have the lowest difference in threshold between switch and no switch conditions out of all the worldviews. As predicted in S3H3c, those holding a *Localised* worldview demonstrated a greater difference in threshold between switch and no switch conditions. There was strong evidence for this when compared to those holding an *Orthodox*, $P = 1.0$, *Reward*, $P = 0.98$, or *Survivor* worldview, $P = 0.98$; and positive evidence when compared to those holding a *Pragmatist* worldview, $P = 0.93$. Furthermore, as predicted in S3H3d, those holding a *Pragmatist* worldview demonstrated a greater difference in threshold between switch and no switch conditions. There was positive evidence for this when compared to those holding an *Orthodox*, $P = 0.91$, *Reward*, $P = 0.77$, or *Survivor* worldview, $P = 0.85$. Besides demonstrating a lower difference threshold between switch and no switch conditions, when compared to those holding a *Localised* or *Pragmatist* worldview, there was weak evidence for a lower difference in threshold between switch and no switch conditions for those holding an *Orthodox* worldview when compared to those holding a *Reward*, $P = 0.75$, or *Survivor* worldview, $P = 0.56$. For this reason, S3H4b is partially supported as those holding an *Orthodox* worldview substantially differed only with those holding a *Localised* or *Pragmatist* worldview.

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Figure 9*Posteriors of Threshold Estimates for all Worldviews During a Switch**Note.* This

graph depicts the likelihood of different values of the threshold (for each worldview) given the data and models used. Larger differences in threshold for the *Localised* and *Pragmatist* worldviews suggests that individuals who endorse either of these two worldviews required more evidence before giving a response during switches when compared to no switches, and more so than individuals who endorse the *Orthodox*, *Reward*, or *Survivor* worldviews.

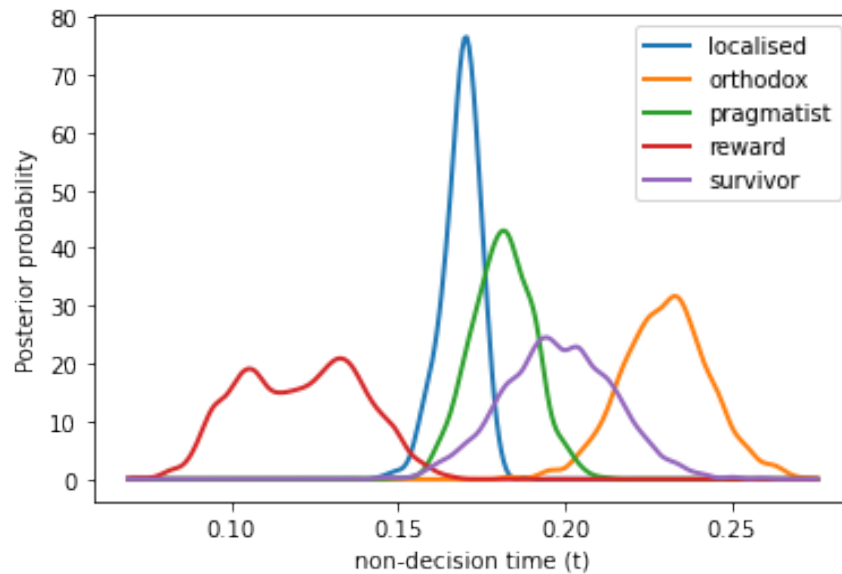
5.9.3 Non-Decision Time

Those holding a *Reward* worldview tended to have the smallest difference in non-decision time between switch and no switch conditions out of all the worldviews (see, Figure 10). There was strong evidence for this when compared to all the other worldviews, $P = 1.0$. Conversely, those holding an *Orthodox* worldview tended to have the largest difference in non-decision time between switch and no switch conditions out of all the worldviews. There was strong evidence for this when compared to those holding a *Localised*, *Pragmatist*, or *Reward* worldview, $P = 1.0$. Moreover, there was positive evidence for this when compared to those holding a *Survivor* worldview, $P = 0.93$.

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Figure 10

Posteriors of Non-Decision Time Estimates for all Worldviews During a Switch



Note. This graph depicts the likelihood of different values of non-decision time (for each worldview) given the data and models used. Smaller differences in non-decision time for the *Reward* worldview suggest that individuals who endorse this worldview suffered the least time cost dedicated to non-decisional processes (e.g., stimulus encoding, motor movements, and response execution) when compared to all the other worldviews.

5.10 Discussion of Drift Diffusion Model Results

As an alternate way to investigate the relationship between worldviews and cognitive flexibility this study implanted a DDM analyses. This yielded some significant findings:

1) All worldviews demonstrated weaker drift rate, greater threshold, and greater non-decision time during a switch when compared to no switch. This means that one was slower and less accurate at the task, required more evidence before making a decision, and tended to spend more time on non-decision processes during a switch when compared to no switch;

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2) When comparing switch to no switch conditions, those holding a *Localised* or *Pragmatist* worldview were associated with a lower difference in drift rate than those holding an *Orthodox*, *Reward*, or *Survivor* worldview. This means that, during switches, the performance for those endorsing a *Localised* or *Pragmatist* worldview did not (negatively) vary as greatly as those endorsing an *Orthodox*, *Reward*, or *Survivor* worldview.

3) When comparing switch to no switch conditions, those endorsing an *Orthodox* worldview were associated with the highest difference in drift rate of all worldviews. This means that, during switches, the performance for those endorsing an *Orthodox* worldview (negatively) varied the greatest out of all the worldviews, suggesting that they were the most affected by the need to switch.

4) When comparing switch to no switch conditions, those endorsing a *Localised* worldview were associated with a greater difference in threshold than those endorsing an *Orthodox*, *Reward*, or *Survivor* worldview. This means that those endorsing a *Localised* worldview demonstrated a greater need to require evidence before making a decision during a switch when compared to those holding an *Orthodox*, *Reward*, or *Survivor* worldview.

5) When comparing switch to no switch conditions, those endorsing a *Reward* worldview were associated with the smallest difference in non-decision time of all worldviews. This means that those endorsing a *Reward* worldview suffered the smallest time cost in processing the stimuli or executing a response during a switch when compared to all the other worldviews;

6) When comparing switch to no switch conditions, those endorsing an *Orthodox* worldview were associated with the largest difference in non-decision time of all worldviews. This means that those endorsing an *Orthodox* worldview suffered the largest

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time cost in processing the stimuli and executing a response during a switch when compared to all the other worldviews.

Overall, these findings support the hypotheses relating to meaningful differences between worldviews in terms of cognitive flexibility.

5.10.1 Letter-Digit Classification Task and DDM Parameters

Findings showed that during a switch individuals tend to seek more evidence before making the decision and the rate with which they accumulate this evidence is slower. Moreover, more time is spent on non-decision processes. Earlier it was shown that reaction times were slower during switches when compared to non-switches. When considered together with the DDM results, these findings may provide valuable insights into the mental strategies employed during task switching. It is reasonable that during a switch one suffers a time cost due to the cognitive effort required to disengage from the previous task demands or mental set and reengage in the new task demands or mental set. What's noteworthy in the present findings is that individuals tend to seek more evidence before making a decision. This offers a more in depth understanding of the time cost that one suffers during a switch. Particularly, this finding shows that not only does one suffer a time cost as a consequence of reallocating cognitive resources, but one also suffers a time cost as a result of seeking more evidence before deciding (Badre & Wagner, 2006; Berg, 1948; Rogers & Monsell, 1995).

5.10.2 Worldviews and Cognitive Flexibility

There is evidence that supports the hypotheses linking the *Localised* and *Pragmatist* worldviews to smaller differences in drift rates and greater differences in

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threshold between switch and no switch conditions when compared to the other worldviews (S3H3a-d). Lower differences in drift rates indicate that the performance of those with a *Localised* and *Pragmatist* worldview tended to be less affected by shifting task demands, suggesting that they are not as sensitive to changes as the other worldviews. Notably, this also suggests that those who found the Letter-Digit Classification Task easier were more likely to endorse one of these two worldviews. Larger differences in threshold values indicate that those who experience a greater need for evidence before executing a response in response to shifting task demands are more likely to endorse the *Localised* and *Pragmatist* worldviews when compared to the other worldviews. Findings from the first study (Chapter 3) showed that the *Localised* and *Pragmatist* worldviews are empirically linked to the value of openness to change. The current findings support others linking openness to change to cognitive flexibility (Brosch et al., 2010; Jost et al., 2003) and it has done so using a task-based measure of cognitive flexibility. Notably, the present findings show that individuals who are better at monitoring task demands and choosing the appropriate strategy to changing goals (larger threshold for harder tasks such as switch conditions and a smaller threshold for easier tasks such as no switch conditions) are more likely to endorse the *Localised* and *Pragmatist* worldviews, and this may result in willingness to embrace alternative new experiences and ways of thinking or behaving. From problem solving to decision making, many facets of our daily lives require some degree of cognitive flexibility (Cañas et al., 2003; Laureiro-Martínez & Brusoni, 2018). Cognitive flexibility is continuously reinforced in individuals who value openness to change, therefore, resulting in better adaptability to changing situations (Hamtiaux & Houssemand, 2012). Undoubtedly, this may be considered an asset in today's rapidly evolving, diverse, and complex societies,

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which may put those with *Localised* and *Pragmatist* worldviews at an advantage over those with other worldviews in such contexts.

In line with S3H3a-d, those with *Orthodox*, *Reward*, and *Survivor* worldviews have been shown to have greater differences in drift rates and smaller differences in threshold values between switch and no switch condition than those with *Localised* and *Pragmatist* worldviews. The drift rate findings suggest that individuals whose performance tended to be the most negatively affected by shifting demands were more likely to endorse the *Orthodox*, *Reward*, and *Survivor* worldviews. Moreover, the threshold findings suggest that individuals who endorse the *Orthodox*, *Reward*, and *Survivor* worldviews may be associated with a narrow range of adaptability due to smaller variations in the need for evidence before executing a response between switches and no switches. It may also be the case that such individuals may be opting to minimise the amount of evidence required before making a decision (threshold) in order to compensate for a low rate of evidence accumulation (drift rate). Though not investigated, it could also be the case that lowering the amount of evidence required serves as a strategy to minimise the increased cognitive load during a switch (Badre & Wagner, 2006; Berg, 1948; Rogers & Monsell, 1995).

Those holding an *Orthodox* worldview emerged as some of the worst performers during the Letter-Digit Classification (S3H4a). Notably, those with an *Orthodox* worldview were associated with greater differences in drift rate values between switch and no switch conditions than those with *Reward* and *Survivor* worldviews. This means that individuals whose performance was the most negatively affected during switches were more likely to endorse the *Orthodox* worldview than the *Reward* or *Survivor* worldviews. Findings from first study (Chapter 3) showed that the *Orthodox*, *Reward*, and *Survivor* worldviews are all associated with the value of conservation. A significant

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conceptual difference between the *Orthodox* worldview and these other worldviews is the strong underlying dogmatic and traditionalist aspect, and the tendency to believe in higher supremacy. For instance, high traditionalism and religiosity could increase close-mindedness by emphasizing the saliency of rules and ritualistic behaviour to maintain stability and social order in one's environment (i.e., moral, and behavioural rigidity) (Atran, 2004; Beit-Hallahmi & Argyle, 1997; Durkheim, 1912/2008). This is also important for strengthening bonds within groups, and in turn, one's overreliance on their own group (i.e., coalitional rigidity) (Atran, 2004). Together these features foster a lifestyle and mindset that limit the ability to think and behave flexibly beyond the established status quo by one's ingroup. Undeniably, therefore, these findings provide further evidence that cognitive flexibility plays a significant role in predicting traditionalism and religiosity, a defining characteristic of the *Orthodox* worldview (Zmigrod et al., 2019b).

Not predicted was that those with an *Orthodox* worldview would have the largest difference in non-decision times between switch and no switch conditions. Non-decision time represents the time it takes to encode and process a stimulus as well as to execute a motor response (Ratcliff & McKoon, 2008; Voss et al., 2004). Based on this understanding of non-decision time, individuals who experience larger sensory and motor delays are more likely to endorse the *Orthodox* worldview. In contrast, those with a *Reward* worldview exhibited the smallest difference non-decision time between switch and no switch conditions. Since non-decision time is related to motor response time (Ratcliff & McKoon, 2008; Voss et al., 2004), these findings potentially link the *Reward* worldview to behavioural impulsivity. Nonetheless, it is worth acknowledging that non-decision time has often been given secondary importance when compared to drift rate and threshold parameters (see, Weindel et al., 2021). Consequently, the cognitive and

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psychological interpretations of non-decision time are limited, and further investigation would be required to ascertain the significance of the non-decision time findings to the present study.

5.11 Conclusion

Together with the findings of the second study (Chapter 4), this study has found further evidence for behavioural differences between those with different worldviews. Notably, this study has shown a meaningful relationship between worldviews and cognitive flexibility and, in doing so, has added to the body of research utilising drift diffusion to model individual differences in a two-alternative choice behavioural task (the Letter/Digit Classification Task). Future research would benefit from a longitudinal investigation of the present findings. More specifically, would the differences in drift diffusion model parameters between the worldviews hold across time and how would they vary under different circumstances? A study on individual differences in intelligence reported good temporal stability for all parameters but only the drift-rate parameter demonstrated stability over different tasks (Schubert et al., 2016). It would be beneficial to investigate whether the same applies for worldviews. The next chapter will discuss the findings that arose from all three investigations (Chapters 3-5) and establish their significance in relation to the primary aims and objectives of this thesis. It will then conclude by reviewing the limitations of the current investigation and outlining potential directions for future research endeavours.

Chapter 6

Discussion

6.1 Summary of Aims

The objective of this thesis was to investigate individual differences in self-regulatory abilities, and to contribute to the theorisation and empirical study of social-cognitive mechanisms of worldviews. Recently, within the field of cognitive science, investigations of individual differences have started to take centre stage. However, due to challenges in measurement and conceptualisation, a focus on the role of belief systems as an individual differences factor, has largely been overlooked. In attempts to offer a fresh outlook, and to diverge from the bulk of research on beliefs that concentrated on political and religious beliefs, this dissertation centred on worldviews. Worldviews are defined as belief systems that are responsible for guiding our sense of self and the world around us, helping us shape our outlook on life, and cope with any changes to our environment (Sammut, 2019; Sammut et al., 2022).

In Chapter 1, it was reasoned that, since worldviews are crucial for enabling individuals to adapt to life circumstances, they could be thought to be conceptually linked to the notion of self-regulation. Self-regulation entails monitoring thoughts, feelings, and behaviour, and adjusting them accordingly in line with goals (Nigg, 2017). Specifically, elements of self-regulation that were of prime focus in this dissertation were inhibitory control and cognitive flexibility, two executive function processes responsible for planning and maintaining goal-directed behaviour (Hofmann et al., 2012; Nigg, 2017). Prior to investigating the relationship between these two processes and worldviews, I started by establishing a link between worldviews and values (Chapter 3). The rationale

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behind this was that, since values are fundamentally intertwined with belief systems (Bond et al., 2004; Usó-Doménech & Nescolarde-Selva, 2016), then a meaningful link with worldviews should be observed. It is worth noting that belief systems differ substantially from singular beliefs as well as schemas. Regarding the former, belief systems offer a more holistic representation of beliefs being that they constitute the necessary interconnectedness of various beliefs (Leung & Bond, 2009; Salvatore et al., 2018). This fundamental characteristic sets belief systems apart from individual, singular beliefs that may exist independently of other beliefs (Usó-Doménech & Nescolarde-Selva, 2016). Conversely, regarding the latter, belief systems differ from schemas in terms of generalisability. Particularly, belief systems are broad and encompass a range of interconnected beliefs, whereas schemas are specific cognitive structures that represent knowledge about specific concepts within a belief system (Koltko-Rivera, 2004; Usó-Doménech & Nescolarde-Selva, 2016). This study facilitated a more in-depth understanding of worldviews by mapping them onto a two-dimensional higher order structure of values (Schwartz, 1992, 2012). In addition, by identifying categorical similarities and differences between worldviews, it also established the groundwork for the later investigations of the cognitive correlates of worldviews.

In the subsequent two studies I investigated the cognitive correlates of worldviews, specifically the relationship between worldviews and inhibitory control (Chapter 4), and worldviews and cognitive flexibility (Chapter 5). The central aim underlying both studies was to investigate whether individual differences in cognition could predispose some individuals towards a worldview more strongly than others. Another goal was to overcome the methodological challenge faced when investigating inhibitory control and cognitive flexibility using objective behavioural measures. The go-to measures and statistical methods for analysing performance in behavioural tasks have

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sometimes proved to be insufficient in detecting meaningful individual differences. For this reason, weak correlations between behavioural data and self-report data have often been reported (see, Dang et al., 2020). In Chapter 5, I adopted a drift diffusion model (DDM) analysis to untangle meaningful differences between worldviews and to add to the limited yet growing body of research using computational models of decision making to investigate individual differences in cognitive processing. In the following I outline the main findings of each study, followed by an all-encompassing discussion detailing the insights and implications derived from this work.

6.2 Summary of Findings

Overall, each study contributed towards the understanding of individual differences in self-regulatory abilities, with a particular focus on worldviews. The first study (Chapter 3) examined worldviews from a socio-cultural domain whereas the second and third studies (Chapters 4 and 5) examined worldviews from a cognitive science domain. Particularly, the second and third studies explored whether differences in self-regulatory abilities (inhibitory control and cognitive flexibility) may predispose certain individuals towards particular worldviews over others. Table 7 provides an overview of the findings relating to these studies.

Study 1 (Chapter 3) laid the groundwork for the investigation of worldviews in two significant ways. Firstly, it drew conceptual links between the notion of worldviews and similar five-factor typologies, namely, (i) symbolic universes (Salvatore et al., 2018), (ii) social axioms (Leung & Bond, 2009), (iii) moral foundations (Haidt, 2012), and (iv) deep stories (Hochschild, 2016). Secondly, it drew empirical links between worldviews and the higher order value dimensions proposed by Schwartz (1992, 2012). Notably, the former was crucial in providing a basis to make predictions on the latter. In the latter,

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through correlational analysis and a series of hierarchical linear regressions, I showed that worldviews exert a significant influence on the value dimensions of *Openness to Change versus Conservation* and *Self-Enhancement versus Self-Transcendence*. On the one hand, regarding the value dimension of *Openness to Change versus Conservation*, I found that the *Localised* and *Pragmatist* worldviews value openness to change, whereas the *Orthodox*, *Reward* and *Survivor* worldviews value conservation. On the other hand, regarding the value dimension of *Self-Enhancement versus Self-Transcendence*, I found that the *Reward* and *Pragmatist* worldviews value self-enhancement, whereas the *Localised* and *Orthodox* worldviews value self-transcendence. Ultimately, the findings of this study signify that even though worldviews may seem quite different to each other, there are unique points of convergence that may be notably attributed to values. By successfully mapping worldviews onto value dimensions, this study played a pivotal role in the subsequent investigations of value-belief-behaviour relations.

Study 2 (Chapter 4) represented the first attempt in this thesis to investigate individual differences in self-regulatory abilities. Specifically, this study investigated whether differences in behavioural inhibitory control are linked to worldviews. In doing so, this study provided the initial insight into the complex interplay between cognitive abilities and worldviews. As noted earlier, inhibitory control is an important executive function process that is implicated in other higher order processes such as self-regulation (Hofmann et al., 2012; Nigg, 2017; Tiego et al., 2018). It is split into three-related but separable functions 1) prepotent response inhibition, 2) resistance to distractor interference, and 3) resistance to proactive interference. Prepotent response inhibition is the ability to suppress automatic or habitual responses in favour of a more goal-direct response (Friedman & Miyake, 2004). Resistance to distractor interference refers to the ability to selectively attend to relevant information and ignore irrelevant or distracting

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information (Friedman & Miyake, 2004). Lastly, resistance to proactive interference describes the ability to navigate between previously relevant information and new information (Friedman & Miyake, 2004). Particularly, in this study, I investigated the function of prepotent response inhibition as measured by performance during the Go/No-Go task (Friedman & Miyake, 2004). The regression analyses revealed that individuals who are better able to inhibit behavioural responses during the Go/No-Go task are more likely to endorse the *Orthodox* worldview. Additionally, correlational analyses revealed that slower and more thoughtful responses are associated with the *Survivor* worldview. These findings show that, even when controlling for working memory capacity differences (a known strong correlate of inhibitory control) there are significant individual differences in inhibitory control that may predispose individuals to particular worldviews. Importantly, in this study I show that it is possible to link self-report measures and behavioural measures, a relationship that is notorious for yielding insignificant or poor findings (e.g., Eisenberg et al., 2019).

Study 3 (Chapter 5) investigated the relationship between cognitive flexibility, considered as another executive function process, and worldviews. Moreover, it provided further evidence for the value of using DDM analysis to untangle individual and group differences that may otherwise remain “undetected” in traditional analyses. Related to cognitive flexibility is task-switching ability, that is, the ability to adjust to changes in the environment through attentional shifting and/or behavioural switching (Dajani & Uddin, 2015; Miyake & Friedman, 2012). In this study, I measured cognitive flexibility through performance during a task-switching paradigm, specifically the Letter-Digit classification task in which participants were required to alternate between different sets of response rules (Rogers & Monsell, 1995). As noted earlier, in an attempt to utilise a more nuanced approach to interpretation of the results, I implemented a DDM analysis.

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DDM models the cognitive process implicated in two-choice decisions tasks and it was for this reason that it was carried out on data pertaining to the Letter/Digit classification task rather than the Go/No-Go task (Chapter 4). By using accuracy and response time data, DDM conceptualises the decision process as an accumulation of evidence over time that eventually crosses one of two boundaries, stops, and then executes the response that corresponds to the selected boundary (Ratcliff & McKoon, 2008). Through the DDM, three separate distinguishable parameters were extracted, namely, drift rate, threshold, and non-decision time. Drift rate is a measure of the efficiency with which one accumulates evidence to make a decision, where high values indicate fast and accurate decisions and low values indicate slow and error-prone decisions (Ratcliff & McKoon, 2008; Voss et al., 2004). With consideration to the switching task implemented in this Study 3 (Chapter 4), it is thought that the greater the difference in drift rates between switch and no switch conditions, the more sensitive one is to shifting task demands. Threshold represents the separation between the upper and lower boundaries and influences how much evidence needs to be accumulated before executing a response (Ratcliff & McKoon, 2008; Voss et al., 2004). Specifically, it quantifies the speed-accuracy trade-off, such that high values indicate a preference towards accuracy over speed, whereas low values indicate a preference towards speed over accuracy (Ratcliff & McKoon, 2008; Voss et al., 2004). With consideration to the switching task implemented Study 3 (Chapter 4), it is thought that the greater the difference in threshold between switch and no switch conditions, the more adaptable one is in adjusting their need for evidence in response to shifting task demands. Lastly, non-decision time is a measure of the time occupied on non-decisional processes such as the time taken to encode a stimulus and the time taken to execute a motor response (Ratcliff & McKoon, 2008; Voss et al., 2004). With consideration to the switching task implemented in Study

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3 (Chapter 4), it is thought that the lower the differences in non-decision time between switch and no switch conditions, the lower the time cost in processing efficiency and response execution in response to shifting task demands. A number of significant findings emerged through the the analyses: 1) All worldviews demonstrated weaker drift rate, smaller threshold, and greater non-decision time during a switch when compared to a non-switch. This validated the scope of the task as it provided evidence for poorer performance during a switch when compared to a non-switch; 2) When comparing switch to no switch conditions, individuals holding a *Localised* or *Pragmatist* worldview were associated with a lower difference in drift rate than those holding an *Orthodox*, *Reward*, or *Survivor* worldview., suggesting that those whose performance suffered the least due to switching tended to endorse the *Localised* or *Pragmatist* worldview over the *Orthodox* worldview; 3) When comparing switch to no switch conditions, individuals holding an *Orthodox* worldview were associated with highest difference in drift rate when compared to all other worldviews, suggesting that those whose performance suffered the most due to switching tended to endorse the *Orthodox* worldview over all the other worldviews; 4) When comparing switch to no switch conditions, individuals holding a *Reward* worldview were associated with the smallest difference in non-decision time when compared to all other worldviews, suggesting that those who experienced the shortest time cost in terms of non-decisional processes tended to endorse the *Reward* worldview over all the other worldviews; 5) When comparing switch to no switch conditions, individuals holding as *Orthodox* worldview were associated with the largest difference in non-decision time when compared to all other worldviews, suggesting that those who spent suffered the largest time-cost in terms of on non-decisional processes tended to endorse the *Orthodox* worldview over all the other worldviews. Taken together these findings provide evidence of a strong and meaningful relationship between task-

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switching ability/cognitive flexibility and worldviews. Furthermore, though indirectly, I have also shown that such a relationship between cognitive flexibility and worldviews may be predicted on the basis of the higher-order value dimensions of *Openness to Change versus Conservation* (Chapter 5).

Table 7*Overview of Findings Relating Worldviews to Values, and Individual Differences in Inhibitory Control and Cognitive Flexibility*

	Self-Transcendence (S-T) / Self-Enhancement (S-E)	Openness to Change (OC) / Conservation (C)	Inhibitory Control			Cognitive Flexibility		
			False Alarm Rate ¹	d' ²	Response Bias ³	Drift Rate Differences (v) ⁴	Threshold Differences (a) ⁵	Non-Decision Time Differences (t) ⁶
Localised	S-T ^{Ref}	OC ^{Ref}	High	Low	High	Small ^{Ref}	Large ^{Ref}	Large
Orthodox	S-T ^{Ref}	C ^{Ref}	Low ^{Ref}	High ^{Ref}	Low ^{Ref}	Large	Small	Large
Pragmatist	S-E	OC	High	Low	Low	Small ^{Ref}	Large ^{Ref}	Large
Reward	S-E	C	High	Low	High	Large	Small	Small ^{Ref}
Survivor	S-E	C	High	Low	High	Large	Small	Large

Note. ⁽¹⁾ False Alarm Rate refers to the of proportion errors during No-Go trials in the Go/No-Go task. ⁽²⁾ d' is a measure of the ability to discriminate between the two different types of stimuli in the Go/No-Go task. High values suggest that one is very good at discriminating between the Go and No-Go stimuli, hence, one is more accurate. Conversely, low values suggest the opposite. ⁽³⁾ Response Bias refers to the tendency to consistently give a response during the Go/No-Go task. High values suggest that one consistently tend to give a response, even when not required during No-Go trials. ⁽⁴⁾ Drift rate differences refers to the differences in the rate of evidence accumulation between switch and no switch conditions. Large differences suggests that one's performance is greatly affected between switches and no switches, whereas low values suggest the opposite. ⁽⁵⁾ Threshold difference refers to the differences in the amount of evidence required before making a decision between switch and no switch conditions. Large differences suggest that one greatly varies the need for evidence between switches and no switches suggest the opposite. ⁽⁶⁾ Non-decision differences time refers to the differences in time spent on non-decisional processes such as stimulus encoding and response execution between switch and no switch conditions.

^{Ref} Denotes the worldview that was selected as the reference category (i.e., the worldview to which other worldviews were compared to) during the analyses.

6.3 Interpretations and Implications

Overall, findings have shown that there are noteworthy individual differences in self-regulatory abilities. Particularly, by drawing upon contributions and insights from both social psychology and cognitive science, findings have provided a more holistic understanding of the complexities of self-regulatory ability. In the following, I discuss three predominant interpretations and implications of these findings. The first outlines an argument on the importance of investigating individual differences to advance our knowledge of cognition. The second outlines a view of utilising worldviews as a means of bridging social psychology theory with cognitive science perspectives, aiding inquiries within individual differences research. The third and final outlines the practical relevance of the findings within society by discussing how the points of convergence and divergence between worldviews, with respect to values and executive function, may facilitate coalitional processes.

6.3.1 Evidence for the Importance of Individual Differences

At the start of this thesis, it was argued that the notion that worldviews allow individuals to adjust to changing circumstances, relates worldviews to self-regulation (Sammut, 2019). Notably, in Chapter 1, I reviewed the concept of a dual-systems perspective of self-regulation. Bottom-up processes entail spontaneous or reactive responses that can either be approach or avoidant and are highly influenced by the presence of an external stimulus (e.g., Carver, 2006; Phaf et al., 2014). Furthermore, they are typically associated with motivation and emotion which are responsible for reward valuations that favour short-term gratifications (e.g., Chiew & Braver, 2011; Inzlicht et al., 2015). However, more relevant to this thesis were top-down processes which are

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concerned with those cognitive processes, such as executive functions, that require working memory and have a limited capacity (e.g., Hagger et al., 2010; Hofmann et al., 2012). In comparison to bottom-up processes, these processes act slower and entail effortful and higher-order mental operations that favour long-term gratifications (Hofmann et al., 2009). Notably, the executive functions investigated in Studies 2 and 3 (Chapters 4 and 5, respectively) are considered to occupy a central role in top-down self-regulation (Nigg, 2017).

Studies 2 (Chapter 4) and 3 (Chapter 5) show that individuals with particular self-regulatory abilities may be more inclined to endorse a particular worldview over another. This suggests that different approaches to self-regulation give rise to diverse worldviews and variations in the perception of what constitutes the most effective strategy to pursue one's goal. For instance, the *Orthodox* worldview and the *Localised* worldview demonstrate contrasting abilities in relation to inhibitory control and cognitive flexibility. On the one hand, individuals who demonstrate exceptional inhibitory control but struggle with cognitive flexibility are most likely to endorse the *Orthodox* worldview. On the other hand, individuals who demonstrate exceptional cognitive flexibility but struggle with inhibitory control are more likely to endorse the *Localised* or *Pragmatist* worldviews. Also, impulsive behaviour in both instances that require inhibitory control as well as cognitive flexibility is linked to the *Reward* worldview. These findings lend support to the notion that self-regulation involves more than executive function processes, as it is also linked to worldviews and values. Furthermore, it lends support to the claim posed by 4E theorists; that cognition is not solely confined to the brain but is shaped and supported by the interactions between the brain, body, physical environment, and social environment (Newen et al., 2018). A theory that offers an explanation as to how different types of self-regulatory abilities were observed between the worldviews is

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the theory of personality systems interactions (PSI theory) (Kuhl & Baumann, 2021). The PSI theory claims that the exchange of information between individual disposition and psychological system together with the influence of social context leads to shifts in one's beliefs, attitudes, and behaviour (Kuhl & Baumann, 2021). Therefore, according to this theory, individual differences in self-regulatory mechanisms are likely to be observed as a result of the interplay between disposition, psychological processes, and environmental context. Ultimately, identifying such differences is essential for fostering a better understanding of what is meant by effective self-regulation. If self-regulation is only understood in terms of self-control, one could say that individuals with an *Orthodox* worldview are effective at self-regulation, whereas those with *Localised* or *Pragmatist* worldviews are not. Therefore, I assert that it is important to detail the particular context when investigating effective self-regulation. Individuals with an *Orthodox* worldview would be better suited for scenarios that incentivise engaging executive control over habitual behaviour. Conversely, those with a *Localised* or *Pragmatist* worldview would be better suited for scenarios that incentivise flexibly reconfiguring thoughts and actions. It's crucial to emphasise that these findings are not solely relevant to the domain of self-regulation. More significantly, these findings make it abundantly clear that ignoring individual differences is a missed opportunity for advancing knowledge of certain cognitive processes. Indeed, they show that one can no longer afford to operate within a cognitive science framework that neglects individual differences but, instead, one should attempt to integrate the exploration of individual differences within their investigation of cognitive processes.

Another notable conclusion is the importance of shifting away from the sole use of traditional analyses, such as those involving the averaging of behavioural measures (reaction time or accuracy), in favour of incorporating alternative approaches, such as

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sequential sampling models that are more nuanced at detecting individual differences (e.g., Pleskac et al., 2019; Ratcliff et al., 2010; Ratcliff, Smith, et al., 2016; Schubert et al., 2019). Sequential sampling models (e.g., the drift diffusion model) offer robust statistical power by combining speed and accuracy data, and modelling them across the decision-making process rather than averaging and assuming that the decision-making process is a static process (Ratcliff, 1978; Ratcliff & McKoon, 2008). Importantly, such models allow researchers to decompose behaviours into a number of parameters that are associated with particular cognitive processes (Ratcliff & McKoon, 2008; Voss et al., 2004). Moreover, sequential sampling models offer the opportunity to compare different model variants (e.g., that factor in individual differences) and assess which is best to explain the observed data (e.g., Johnson et al., 2017). Nevertheless, it is worth noting that while sequential sampling models are powerful tools, their applicability is context dependent. In Study 2 (Chapter 4), since drift diffusion modelling is not suitable for data in which a response is not captured (such as the Go/No-Go task where no explicit response is coded for successful No-Go trials), individual differences were investigated through “traditional analyses”. Indeed, Study 3 (Chapter 5) showed that it worth exploring more sophisticated analytical approaches. Ultimately, when it comes to individual differences, an underexplored area of cognitive science, researchers should not hesitate to embrace a diverse “tool kit” of statistical analyses. Adopting a more versatile and comprehensive array of statistical methods allows for a more rigorous understanding of individual differences in cognitive processes by uncovering hidden insights into the complexity of observed behaviour.

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6.3.2 *An Opportunity for Interdisciplinary Research*

In the pursuit of knowledge, it is imperative to transcend the boundaries between different disciplines. Investigations from a single perspective are often inadequate for developing a comprehensive and holistic understanding of complex concepts. Indeed, the complex nature of worldviews necessitates going beyond the confines of an individual discipline. In the first study (Chapter 3), I adopted a social psychological and cultural perspective to delve deeper into the notion of worldviews. Being that worldviews are social in nature, this was an essential step to gain insight into how individual factors and social factors interact to shape one's outlook on life. Such a perspective also provided a unique understanding of the psychological processes that influence one's behaviour. Furthermore, and of greater significance, it has allowed for the possibility to untangle the notion of worldviews, rendering it more tangible and concrete for the later investigations (Chapters 4 and 5) that adopted a cognitive science perspective. Ultimately, though there is a distinct divide between the two disciplines, it is worth acknowledging the mutual benefits and contributions that each can offer to the other, facilitating the development of more complete causal models. Potential overlaps can be found within research on dual-processing systems and research on the need for cognitive closure.

Dual-Processing Systems. Both social psychology and cognitive science have made significant contributions to the understanding of dual-processing systems. Most prominently, from cognitive science, is the two processing systems proposed by Kahneman (2003), intuition (system 1) and reasoning (system 2). This is akin to the elaboration likelihood model (ELM) proposed by Petty and Cacioppo (1986) which outlines the two basic routes to persuasion. The first route, referred to as the central route,

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involves thoughtful evaluation of information and argument, whereas, the second route, referred to as the peripheral route, involves heuristic processing. Both bear resemblance to system 1 and system 2 respectively. Worldviews have the potential to be incorporated in the framework of both models and theories. Notably, the findings from Studies 2 and 3 (Chapters 4 and 5, respectively), linking worldviews to top-down self-regulatory processes suggests that worldviews may likely play a role in the central route and system 2 thinking. These findings have shown that when individuals encounter situations requiring conscious and deliberate thought as well as the suppression of intuition or impulse, they evaluate information and act in a way that aligns with their worldview. This may hold true across various contexts. For instance, with reference to the ELM, when faced with persuasive messages or social arguments, individuals will be more receptive to information that aligns with their existing beliefs and values, and that are congruent with their worldview (Petty & Cacioppo, 1986). Here, worldviews act as a lens through which information is processed and filtered, leading individuals to selectively attend to information. In essence, it is plausible to pose that worldviews exert a strong influence on system 2 thinking resulting in differences to become most evident once individuals are cognitively engaged.

Need for Cognitive Closure. The need for cognitive closure (NFC) is a construct proposed by Kruglanski (1989) that relates to the theory of motivated social cognition and that explains the motivational aspects that influence individuals' judgement and decision-making processes. It also explains individuals' approach to knowledge acquisition through the dynamic interplay between the need to avoid ambiguity and the need to reach a state of certainty (Kruglanski, 1989). There exist stable individual differences in the extent to which individuals seek cognitive closure (Kruglanski, 1989; Webster & Kruglanski, 1994, 1997). Individuals with a high need for closure desire order

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and structure and tend to be close-minded. Conversely, individuals with a low need for closure are more tolerant of ambiguity, and tend to be open-minded (Kruglanski, 1989; Webster & Kruglanski, 1994, 1997). Though mostly popular within the domain of social psychology, the construct of NFC may be valuable to cognitive science theories of decision-making processes (e.g., Evans et al., 2017). Notably, the decision-making parameter, threshold, holds significance as it captures the balance between caution and urgency (i.e., speed-accuracy trade-off) that has been shown to be linked to NFC (Evans et al., 2017). Findings from Study 3 (Chapter 5) showed distinct variations amongst worldviews in the amount of evidence required before triggering a decision (i.e., threshold). By drawing upon social psychological contributions such as NFC, one can develop a deeper understanding of these differences. Particularly, Study 3 (Chapter 5) showed that individuals who do not adapt the amount of evidence required before forming a decision (i.e., maintaining the same strategy despite varying demands) are more likely to endorse the *Orthodox*, *Reward*, or *Survivor* worldviews. Owing to this lack of adaptability, it is plausible that such individuals may potentially demonstrate higher levels of cognitive closure than individuals who endorse the *Localised* and *Pragmatist* worldviews, who are comfortable in fluctuating amongst different decision thresholds (i.e., gathering more or less evidence depending on task demands). In day-to-day life this may be observed in the way individuals shape their opinions regarding particular social issues or policies. For instance, those who are not flexible in adapting their need for evidence may be less inclined towards delving deep into complex issues, potentially exacerbating confirmation bias, such that they only seek out information that favours their existing beliefs and that prove to be simple and definitive. Indeed, findings from Sammut et al. (2022) showed that those with the *Orthodox* worldview stood out in their resistance towards certain proposals when compared to those holding any of the

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other worldviews. Drawing upon the findings of Study 3 (Chapter 5), it may be the case that, for those holding an *Orthodox* worldview, the rigidity in terms of seeking information beyond what aligns with their current beliefs may have contributed towards the resistance reported in Sammut et al. (2022). Without a doubt, further empirical work needs to take place to establish whether the present findings can be translated into such everyday behaviours. Nevertheless, given the growing interest in exploring individual differences in cognitive processes (e.g., Ruiz et al., 2019; Zmigrod, et al., 2019a), it is certainly worthwhile to pursue collaborative endeavours between the fields of cognitive science and social psychology.

6.3.3 Social Implications of Individual Differences in Inhibitory Control and Cognitive Flexibility

Inhibitory control is important because it involves the ability to restrain from impulsive behaviour, an ability that is fundamental for engaging in socially appropriate behaviour. Likewise, cognitive flexibility is important because it allows individuals to consider multiple perspectives and alternative viewpoints, allowing them to navigate diverse social environments. Undeniably the association between inhibitory control, cognitive flexibility, and worldviews offers valuable insight as to how cognition influences action and behaviour within the wider social sphere, as for instance, in understanding the acceptance or rejection of particular social policies, and in conflict resolution. Moreover, this association also provides insight in the formation of alliances and coalitions. A fundamental aspect of human behaviour is the social ability to form alliances and coalitions with others in pursuit of common ends or, individual or collective interest. In fact, it is thought to play an even more important role than category membership (in-group/out-group) in predicting behaviour in particular social interactions (Cikara, 2021; Pietraszewski et al., 2014, 2015). Factors such as ideological and political

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beliefs have been shown to have significant impact on coalitional psychology as they act as cues that activate the alliance detection system, a system that is responsible for handling coalitions and alliances (Kurzban et al., 2001; Pietraszewski et al., 2014, 2015). For this reason, I believe that worldviews too may play a similar role in coalitions, aiding in the identification of potential allies and threats, and further facilitating the formation of coalitions. Furthermore, I believe that worldviews play such a role by virtue of their association with inhibitory control and cognitive flexibility. In the following I elaborate on how worldviews, that are shaped by differences in inhibitory control and cognitive flexibility, have practical implications on coalitional formations.

Worldviews as Coalition Mechanisms. From a social psychology perspective, a way in which the coalitional function of worldviews may be understood is partly in terms of the worldview conflict hypothesis (Brandt & Crawford, 2020) and partly in terms social identity theory (Tajfel & Turner, 1979). According to the worldviews conflict hypothesis, individuals will express prejudice towards others perceived to hold conflicting worldviews and values. Furthermore, by drawing upon social identity theory (Tajfel & Turner, 1979), this shows how worldviews form part of the important foundation of one's identity and sense of belonging. This means that tension and hostility between individuals could not only be attributed to inhibitory control and cognitive flexibility differences, as noted in the aforementioned, but it could also be attributed to worldview differences (Brandt & Crawford, 2020). Nonetheless, findings from Study 1 (Chapter 3) show that, even though some worldviews are widely different to each other, there are unique points of convergence that may notably be attributed to values. This relationship may explain how, in certain contexts, coalitions are still formed between individuals with different worldviews. Consider the case in which some individuals

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choose to come together and agree to support a cause or a course of action despite their differences. Such agreement necessitates the amalgamation of various perspectives and belief systems. For example, an alliance is likely to be observed between individuals who hold a *Localised* worldview and those who hold an *Orthodox* worldview. Both these worldviews subscribe to an egalitarian view of the world and are motivated to go beyond selfish desires in order to help others. The convergence of such values and motives amongst these two worldviews has the potential of facilitating collective action and cooperation towards particular, mutually desired goals. However, this coalition may dissolve should the social debate emphasise the dichotomy between the values of openness to change and conservation. Those who endorse a *Localised* worldview are open to independence and are unrestricted by the need to abide by social order, whereas those who endorse an *Orthodox* worldview are more self-restricting and more comfortable acting within the confines of tradition and society. Given this scenario, those with an *Orthodox* worldview are then more likely to form an alliance with those holding a *Reward* worldview. The *Orthodox* and *Reward* worldview both desire to uphold peace and harmony within their own social group and are more likely to mutually agree on projects that, for instance, call on “policing” the status quo in order to deter individuals from veering away from group norms. Moreover, when also taking into consideration the reciprocal relationship between worldviews and cognition, as evidenced in Studies 2 and 3 (Chapters 4 and 5, respectively), this coalitional aspect of worldviews emphasises the importance of accounting for cultural factors when studying cognition and behaviour. In summary, I argue that worldviews play an important role in promoting social cohesion and cooperation, which are essential factors for sustaining largely harmonious communities.

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The need to engage in collaboration and the social-cognitive skills required for it is not exclusive to humans. Growing evidence suggests that apes, the species with which humans share the closest common ancestor, possess substantial social-cognitive skills, such as, understanding what others see (i.e., gaze following) (Bräuer et al., 2005), how to manipulate others to get what they want (Völter et al., 2015), engaging in complex group activities (e.g., collaborating with other to obtain food) (Melis & Tomasello, 2013), and learning from others (Yamamoto et al., 2013). Hermann et al. (2009) have reported that early in ontogeny, human children show superior social-cognitive skills that they do not show in other cognitive domains. In their study comparing the cognitive abilities of human children, chimpanzees, and orangutans, the authors reported little significant differences between human children and apes in terms of the cognitive skills for dealing with space, quantities, and causality. However, significant differences did occur when factoring in the cognitive skills required for dealing with the social world, such that human children were more skilled in social learning and communication than apes. In earlier work, Tomasello et al. (2005) posit that such social-cognitive skills crucially distinguish humans from apes. Humans have not only developed social-cognitive skills solely geared towards competition, but also social-cognitive skills aimed at complex forms of cooperation (Tomasello et al., 2005; Tomasello & Carpenter, 2007). Importantly such skills are the fundamental driving force behind shared intentionality (Tomasello et al., 2005). Shared intentionality describes the ability of individuals to “share psychological states with one another” (Tomasello & Carpenter, 2007, p. 121) enabling them to collaborate effectively in pursuit of a common objective even if it does not directly benefit them. I believe that inhibitory control and cognitive flexibility, and their manifestation in worldviews provide a framework for explaining such shared intentionality. Particularly, I contend that worldviews are fundamental to shared

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intentionality by providing a mutual interpretation of the world and how to act in it. Inhibitory control and cognitive flexibility, and their relationship with worldviews serve as a way for humans to co-ordinate not only joint actions (i.e., the co-ordination seen in apes), but also complex mental states that foster collaboration and support intricate social dynamics that go beyond that exhibited by apes and other species.

6.4 Future Research

While this research has presented noteworthy findings, it also exhibits shortcomings that are worth addressing in future research. First and foremost is that the measurements of executive function processes relied solely on a single task for each process. Known as the task impurity problem, this emerges as a result of the interconnectedness of cognitive processes, making it very challenging to isolate and accurately capture the specific cognitive process under investigation (Burgess, 1997). The best way to alleviate this issue in future research is to implement multiple task measures targeting some specific cognitive process and then using a latent variable approach to identify any commonalities amongst these tasks (Snyder et al., 2015). For instance, with regards to inhibitory control, other behavioural measures often used to target prepotent response inhibition are the stop-signal task (Verbruggen & Logan, 2008) and the Stroop task (MacLeod, 1991). Conversely, with regards to cognitive flexibility, another popular behavioural measure includes the Wisconsin Card Sorting Task (Milner, 1963; Stuss et al., 2000). Ultimately, adopting more than one measure has the potential to lead to an overall more reliable measure of the targeted cognitive process, and, in turn strengthening the otherwise often reported weak correlations between self-report measures and behavioural measures (Dang et al., 2020). Additionally in relation to this, even though the selected tasks have successfully been used in the context of individual

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differences (e.g., Friedman et al., 2008; Jost & Amodio, 2012; Yu et al., 2014) some evidence suggests that, since these tasks were not built with individual differences research in mind, they are not ideal for these purposes (see, Dang et al., 2020). Particularly, self-reports have sometimes correlated poorly with behavioural measures (e.g., Eisenberg et al., 2019). Future research could investigate which inhibitory control tasks, or perhaps statistical methods, are particularly best suited to detect nuances in behaviour between individuals and which, therefore, are most ideal for research in similar contexts as the present study. It would also be beneficial for future research to investigate whether the present findings can be replicated using more complex and ecologically valid cognitive tasks that similarly target inhibitory control and cognitive flexibility.

Secondly, in this research I investigated the cognitive correlates of worldviews through the use of behavioural measures pertaining to particular executive functions. Future research could investigate the cognitive correlates of worldviews by looking into neural activity. Specifically, an error-related potential (ERP) - oriented investigation offers a novel approach to study individual differences in self-regulation. As noted in Chapter 1, two ERP correlates of interest within the domain of self-regulation are the N200, an index of cognitive control, and the error-related negativity (ERN), an index of performance monitoring. Due to the lack of collaboration between the disciplines of cognitive science and social psychology, the investigation of such electrophysiological correlates, or any other neural measure, with respect to socially related beliefs (including worldviews) and social behaviour, has been overwhelmingly lacking. Studies that have, to a small extent, approached such an investigation have included those concerned with political ideology. For example, in a salient study in this domain, Amodio et al. (2007) found evidence for a link between self-reported political attitude and the error related negativity (ERN). The authors demonstrated that those who endorse a stronger belief in

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liberalism have a larger ERN amplitude, suggesting a higher sensitivity to incentives for altering habitual responses. These findings have been replicated and extended. Weissflog et al. (2010) reported larger N200 amplitudes amongst those with a stronger liberal orientation. Related findings in a later study (Weissflog et al., 2013) indicated that egalitarianism as opposed to traditionalism was associated with increased behavioural accuracy and neural activity, as reflected by larger ERN and N200 amplitudes, during a response inhibition task. In addition, another study (Inzlicht et al., 2009) reported smaller ERN amplitudes in those measuring high in religiosity. These findings demonstrate the potential of extending the investigation of electrophysiological correlates to worldviews. More importantly, it will enable novel investigations that, rather than focusing on ideological attitudes (e.g., Amodio et al., 2007; Inzlicht et al., 2009; Weissflog et al., 2010, 2013), focus on worldviews, the fundamental underpinnings that constitute differences in individuals' way of thinking. When compared to ideological attitudes, which tend to be narrower and tied to specific issues or principles, worldviews are more comprehensive because they describe the lens through which people broadly interpret their reality and make sense of their existence. For this reason, I believe that worldviews offer the opportunity for a more versatile investigation of group divisions that has the potential to target a wider array of contexts.

Thirdly, in this research, I established a link between worldviews and executive function, however, it remains to be investigated how worldviews are associated with one's higher-level cognitive skills and general behaviours. For instance, consider the model proposed by Norman and Shallice (1986) in relation to the control of action which describes a framework in which schemas are utilised to guide the mapping of appropriate responses (see, Chapter 1). In this framework, the supervisory system is referred to as a key system involved in active thinking (Norman & Shallice, 1986; Shallice, 2002). Since

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set switching (i.e., cognitive flexibility) and response inhibition are both considered to be essential elements of the supervisory system, they may also be considered as prerequisites of active thinking (Shallice, 2002). Future investigations could explore how the effective self-regulatory process associated with each worldview (i.e., inhibitory control and cognitive flexibility) influences what form of active thought or higher-level thinking one is more apt at. For instance, do individuals with a *Localised* and *Pragmatist* worldview possess better creative problem-solving skills owing to better set-shifting ability/cognitive flexibility? Conversely, are individuals with an *Orthodox* worldview better at reasoning in well-structured problem spaces?

Finally, the interactions between values, worldviews, and executive function give rise to the question as to if and how worldviews may change over time. Worldviews are adaptive systems, having the potential to be changed with shifting environmental and social contexts, as well as personal dispositions such as motivation. Developmentally, some people face certain circumstances from birth onwards that may be markedly different from those faced by others, predisposing them to a particular worldview over another. Consequently, one wonders whether worldviews change in the face of changing life circumstances and what processes govern such adaptation. For instance, one could determine whether adverse life events like divorce or job loss could nudge individuals towards a *Survivor* worldview. In this light, it would be worth looking at the role played by certain demographics in the endorsement of worldviews and the extent to which this endorsement may be a function of grand ecological circumstances that mark generational eras. For instance, another demographic factor worth acknowledging is the level of education. A higher level of education is known to act as a catalyst for expanding knowledge, engaging in critical thinking (Huber & Kuncel, 2016), increasing tolerance towards diverse others (Hainmueller & Hopkins, 2014), and facilitating political and

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civic engagement (Chan, 2016). Owing to this, for instance, one might expect that a higher level of education may predispose individuals towards a *Localised* worldview. Individuals with a higher level of education may be more motivated to address social issues due to the fact that they are exposed to diverse perspectives and are aware of the range of social issues that may accompany them. It would be worth exploring whether this is the case and, if so, to what extent does education play a role in worldviews when compared to other factors such as socioeconomic background. Ultimately, tracking worldviews may help identify emerging trends in relation to particular social issues. For example, understanding how the increasing diversification of communities may influence changes in worldview provides valuable insights into societal attitudes, policies, and practices related to diversity and social cohesion, enabling positive societal change. In addition, longitudinal research is also important to identify the particular worldviews that are best suited for certain circumstances which in turn may help inform successful strategies for addressing current and future challenges, thus, placing social-cognitive research as central to the understanding of nation-wide social issues.

Chapter 7

Conclusion

This thesis had two primary objectives: 1) to provide evidence for the importance of investigating inter-individual variation in cognitive processing, and 2) to contribute to the theorisation and empirical study of social-cognitive mechanisms of worldviews. Individual differences in inhibitory control and cognitive flexibility were investigated in Study 2 (Chapter 4) and Study 3 (Chapter 5). Groundwork for these studies was laid out in Study 1 (Chapter 3) which developed a more comprehensive understanding of worldviews by exploring the higher order values that underlie them. Data for all studies was collected through a comprehensive online two-session data collection exercise, that incorporated the measures for worldviews and values (see, Appendix B.1 and B.2, respectively), inhibitory control (Go/No-Go task), cognitive flexibility (Letter-Digit Classification task), and working memory capacity (Operation Span task).

In Study 1 (Chapter 3) I found that participants with *Localised* and *Pragmatist* worldviews value openness to change, whereas those with *Orthodox*, *Reward* and *Survivor* worldviews value conservation. Moreover, I also found that those with *Reward* and *Pragmatist* worldviews value self-enhancement, whereas those with *Localised* and *Orthodox* worldviews value self-transcendence. These findings show that, though Schwartz's value theory and the concept of worldviews are distinct frameworks, there is a degree of meaningful correspondence between the two. Taken together with findings linking other belief systems such as social axioms (Leung et al., 2007), and moral foundations (Feldman, 2020), to values, this study has advanced a more contextual understanding of beliefs concerning oneself and the world around them.

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Perhaps the most important contributions of this thesis, are the findings from the individual differences investigations from Study 2 (Chapter 4) and Study 3 (Chapter 5). These two studies demonstrated that inhibitory control ability and cognitive flexibility are linked to one's worldview. Particularly, in Study 2 I found that those who demonstrate exceptional inhibitory control ability are more likely to endorse an *Orthodox* worldview over any other worldviews. Conversely, in Study 3 I found that those who demonstrate better cognitive flexibility skills are more likely to endorse the *Localised* or *Pragmatist* worldview over any other worldview. In earlier research investigating individual differences in performance monitoring, Weissflog et al (2013) reported a positive relationship between traditionalist socio-political attitudes and behavioural responses relating to control. In other later research, Buechner et al. (2020) reported a positive relationship between liberal socio-political attitudes and response updating. Though in Study 2 and Study 3 the direction of causality was not directly investigated, it is reasonable to assume that inhibitory control ability and cognitive flexibility may both potentially play a role in predisposing individuals to endorse a particular worldview over another. Indeed, the findings of this thesis corroborate and extend such research by showing that cognitive abilities can influence not only domain-specific beliefs like political or religious beliefs (e.g., Amodio et al., 2007; Buechner et al., 2020; Inzlicht et al., 2009; Weissflog et al., 2013), but also more generalised beliefs such as worldviews. This suggests that our cognitive abilities play a significant role in shaping our beliefs across various domains of life.

This thesis has also contributed to the area of social cognition. I believe this research offers intriguing indications of how cognitive abilities might affect social interactions in particular contexts. On the one hand, better cognitive flexibility is linked with adopting a *Localised* worldview. Such individuals play a crucial role in society

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because they may be better able at seeing issues from different angles and weighing up various social arguments. By fostering the ability to consider various perspectives, their better cognitive flexibility may potentially act as a corner store for effective social interaction and societal evolution. This contributes to social cohesion, thereby potentially mitigating the risk of conflict arising among different individuals or social groups. On the other hand, better inhibitory control is associated with adopting an *Orthodox* worldview. Such individuals contribute to society because they may be better at adhering to social norms and rules, thereby leading to a more peaceful society. Each worldview has its own unique contribution, and understanding the interplay between these worldviews and cognitive processing yields considerable advantages; it provides profound insights into how individuals navigate their social landscapes.

I believe that this thesis has effectively achieved the objectives laid out in the introduction. The research I have presented serves as compelling evidence of the importance of delving into individual differences in cognitive processing. Taken together, the three studies have shown that inhibitory control and cognitive flexibility ability share a meaningful relationship with worldviews and values. Moreover, these studies also provide insight into how cognitive abilities can vary significantly among individuals. While convenient, the prevailing “one-sizes-fits-all” framework within cognitive science oversimplifies the complexity of human cognition and behaviour. Indeed, this thesis has shown that the tools and methods used to measure cognitive processes are not always adequate for measuring individual differences since they have been typically designed to minimise inter-individual variations whilst maximising uniform behaviour and improving experimental reliability (Dang et al., 2020; Hedge et al., 2018). Ultimately, more efforts are needed to develop better suited tools and methods for the investigation of individual differences. Nevertheless, despite such methodological

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challenges, the present research has provided further evidence that human beings are incredibly diverse, and their cognitive abilities contribute significantly towards their outlook on the world. Evidently, what one individual might be particularly good at may not be the case of another individual, and the lens through which one interprets the world offers a way of understanding this.

It is worth acknowledging that this research is indebted to disciplines beyond the domain of cognitive science. An investigation of the social cultural processes that shape worldviews was essential for disentangling the interplay between worldviews and cognitive processing. This is noteworthy because it highlights the fruitfulness of interdisciplinary collaboration when aiming to investigate individual differences in cognition. Adopting a singular approach overlooks the important contributions from diverse fields, limiting a comprehensive understanding of cognition. Moreover, it limits the ways in which findings can be applied to inform practical interventions in an array of sectors. Ultimately, the need for interdisciplinary collaborations in investigations of individual differences in cognition underscores the complexity of human cognition and the various ways in which it influences our interactions.

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Appendix A**Information Sheet and Consent**

Please take time to read the following information carefully:

This study comprises of 2 sessions. This is the first session.

The second session will be made available to you within 48hrs after the first session.

It is very important that you are able to take part in both sessions.

Details and payment of sessions is as follows:

1st session

Time to complete - 20 minutes

Payment - £2.50

2nd session (to be made available within 48hrs after the 1st session - you will be notified as soon as it is made available)

Time to complete - 25 minutes

Payment - £4.50

NOTE: It is very important that you also take part in the second session in order to receive full payment.

What is the purpose of the study?

The purpose of this study is to investigate individual differences in adult populations.

What will happen in this first session?

In this first session you will be asked to participate in ****two experiment tasks and a questionnaire****. The two experiment tasks will be hosted on Pavlovia. All task instructions will be presented to you right before the tasks. You will be allowed to carry out practice trials in order to familiarise yourself with the tasks.

The first task should take around ***10*** minutes to complete.

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Once this task is ready, you will be automatically redirected to another task, which should take around *5* minutes to complete.

After completing these two tasks, you will be redirected to Typeform to complete a questionnaire, which should around *5* minutes to complete. ****Please take note of your Prolific ID to have it ready to input in the questionnaire section.****

In the second session you will be asked to participate in an experiment task and a questionnaire. The experiment task will be hosted on Pavlovia. The task instructions will be presented to you right before the task. You will be allowed to carry out practice trials in order to familiarise yourself with the task.

Overall, the experiment task should take around *15-20* minutes to complete.

After completing this task, you will be redirected to Typeform to complete a questionnaire, which should around *5* minutes to complete. ****Please take note of your Prolific ID to have it ready to input in the questionnaire section.****

What will happen to the results of the research study?

The results of this study will be written up and submitted as a piece of work to fulfil the requirements of doctoral studies at the University of Malta. The results may also be published in an academic journal, presented at a conference or used for future research or teaching on the topic. All data will be kept confidential.

How will the data be handled?

All the information collected in this study will be handled according to the provisions of the General Data Protection Regulation (GDPR). You, therefore, have the right to access, rectify and where applicable erase data about yourself.

Contact for Further Information

Please contact the researcher on Prolific if you would like any further information about this study or you would like to obtain a summary of the findings when they have been written up.

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What should I do if I want to take part?

If you have:

Understood the information provided to you here

Are able to participate in the second session made available to you within the next 48hrs

Consent to your participation

Please click on the ****Continue to Experiment**** button at the bottom of this page to proceed.

Appendix B

Questionnaires and Scales

B.1 Worldviews Vignettes and Scale (Sammut et al., 2022)

The following 5 statements describe a particular view. Please rate the extent to which you agree or disagree with each view using a scale from 1 (totally disagree) to 5 (totally agree).

- The future depends on us and the choices we make. Every problem has a solution. Each and every one of us can make an effort to fix the laws and institutions so that they can be just and equal for everyone. Like this we can better address the needs of people and society. 1 2 3 4 5
- In life we must adapt ourselves to our circumstances and sometimes we need to go with the flow in order to avoid trouble. The rich and powerful protect their own interests, whereas the kind-hearted suffer. Sometimes you have to work around the rules to help your loved ones. 1 2 3 4 5
- To succeed in life, we need to follow the rules and local customs in order to maintain social order. We also need to show respect to each other and carry out our duties. Like this we can help others in our community. 1 2 3 4 5
- In life, you get what you deserve. Life's challenges are overcome with the efforts we make, and these may offer new opportunities. One must co-operate with others, respect authority, and carry out one's duties. Our efforts will eventually lead to success. 1 2 3 4 5
- In life, things rarely end up well. People are what they are, and good people usually suffer and are exploited. It is best for one to keep his/her head down and get on with it. 1 2 3 4 5
- Which statement, from the ones you just read, best apply to yourself?

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B.2 PVQ-RR (Schwartz et al., 2012)

In this questionnaire you will be presented with a series of statements that describe a particular individual. For each statement you will be asked to indicate the extent to which you believe that the individual being described in the statement resembles yourself using a scale from 1 (not like me at all) to 5 (very much like me).

- It is important to them to form their views independently. 1 2 3 4 5
- It is important to them that their country is secure and stable. 1 2 3 4 5
- It is important to them to have a good time. 1 2 3 4 5
- It is important to them to avoid upsetting other people. 1 2 3 4 5
- It is important to them that the weak and vulnerable in society be protected. 1 2 3 4 5
- It is important to them that people do what they say they should. 1 2 3 4 5
- It is important to them never to think they deserve more than other people. 1 2 3 4 5
- It is important to them to care for nature. 1 2 3 4 5
- It is important to them that no one should ever shame them. 1 2 3 4 5
- It is important to them to always to look for different things to do. 1 2 3 4 5
- It is important to them to take care of people they are close to. 1 2 3 4 5
- It is important to them to have the power that money can bring. 1 2 3 4 5
- It is very important to them to avoid disease and protect their health. 1 2 3 4 5
- It is important to them to be tolerant toward all kinds of people and groups. 1 2 3 4 5
- It is important to them never to violate rules or regulations. 1 2 3 4 5
- It is important to them to make their own decisions about their life. 1 2 3 4 5
- It is important to them to have ambitions in life. 1 2 3 4 5
- It is important to them to maintain traditional values and ways of thinking. 1 2 3 4 5
- It is important to them that people they know have full confidence in them. 1 2 3 4 5

- It is important to them to be wealthy. 1 2 3 4 5
- It is important to them to take part in activities to defend nature. 1 2 3 4 5
- It is important to them never to annoy anyone. 1 2 3 4 5
- It is important to them to develop their own opinions. 1 2 3 4 5
- It is important to them to protect their public image. 1 2 3 4 5
- It is very important to them to help the people dear to them. 1 2 3 4 5

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

- It is important to them to be personally safe and secure. 1 2 3 4 5
- It is important to them to be a dependable and trustworthy friend. 1 2 3 4 5
- It is important to them to take risks that make life exciting. 1 2 3 4 5
- It is important to them to have the power to make people do what they want. 1 2 3 4 5
- It is important to them to plan their activities independently. 1 2 3 4 5
- It is important to them to follow rules even when no-one is watching. 1 2 3 4 5
- It is important to them to be very successful. 1 2 3 4 5
- It is important to them to follow their family's customs or the customs of a religion. 1 2 3 4 5
- It is important to them to listen to and understand people who are different from them. 1 2 3 4 5
- It is important to them to have a strong state that can defend its citizens. 1 2 3 4 5
- It is important to them to enjoy life's pleasures. 1 2 3 4 5
- It is important to them that every person in the world has equal opportunities in life. 1 2 3 4 5
- It is important to them to be humble. 1 2 3 4 5
- It is important to them to figure things out themselves. 1 2 3 4 5
- It is important to them to honor the traditional practices of their culture. 1 2 3 4 5
- It is important to them to be the one who tells others what to do. 1 2 3 4 5
- It is important to them to obey all the laws. 1 2 3 4 5
- It is important to them to have all sorts of new experiences. 1 2 3 4 5
- It is important to them to own expensive things that show their wealth. 1 2 3 4 5
- It is important to them to protect the natural environment from destruction or pollution. 1 2 3 4 5
- It is important to them to take advantage of every opportunity to have fun. 1 2 3 4 5
- It is important to them to concern themselves with every need of their dear ones. 1 2 3 4 5
- It is important to them that people recognize what they achieve. 1 2 3 4 5
- It is important to them never to be humiliated. 1 2 3 4 5
- It is important to them that their country protects itself against all threats. 1 2 3 4 5
- It is important to them never to make other people angry. 1 2 3 4 5
- It is important to them that everyone be treated justly, even people they do not know. 1 2 3 4 5

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

- It is important to them to avoid anything dangerous. 1 2 3 4 5
- It is important to them to be satisfied with what they have and not ask for more. 1 2 3 4 5
- It is important to them that all their friends and family can rely on them completely. 1 2 3 4 5
- It is important to them to be free to choose what they do by themselves. 1 2 3 4
- It is important to them to accept people even when they disagree with them. 1 2 3 4 5

Appendix C

Descriptive Statistics

Table C.1a

Descriptive Statistics for Measures of the Go/No-Go Task

Dependent Variable	Mean	Std. Deviation	Median	Minimum	Maximum
Go RT ¹	.366	.065	.350	.240	.690
False Alarm Rate ²	.096	.087	1.00	.000	.390
Hit Rate ³	1.00	.006	1.00	.950	1.00

Note.

¹Large reaction times (RTs) and Inverse Efficiency Scores indicate that individuals took longer to respond to the signal (Go trials).

²Larger False Alarm Rates indicate that individuals were more likely to give a response during No-Go trials.

³Larger Hit Rates indicate that individuals were more likely to give a response during Go trials.

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table C.1b*Descriptive Statistics for Measures of the Go/No-Go Task Grouped by Worldviews*

Worldview	Dependent Variable	Mean	Std. Deviation	Median	Minimum	Maximum
Localised	Go RT	.360	.064	.348	.240	.690
	False Alarm Rate	.122	.085	.095	.030	.390
	Hit Rate	.990	.005	1.00	.970	1.00
Orthodox	Go RT	.361	.066	.345	.280	.500
	False Alarm Rate	.000	.000	.000	.000	.000
	Hit Rate	1.00	0.000	1.00	1.00	1.00
Pragmatist	Go RT	.372	.064	.363	.290	.610
	False Alarm Rate	.072	.086	.033	.000	.340
	Hit Rate	.997	.009	1.00	.959	1.00
Reward	Go RT	.370	.064	.363	.290	.610
	False Alarm Rate	.100	.070	.067	.030	.350
	Hit Rate	.999	.002	1.00	.999	1.00
Survivor	Go RT	.389	.058	.387	.290	.520
	False Alarm Rate	.123	.084	.097	.030	.340
	Hit Rate	.998	.006	1.00	.980	1.00

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table C.2a

Descriptive Statistics for Measures of the Letter-Digit Classification Task During Mixed Trials

Condition	Dependent Variable	Mean	Std. Deviation	Median	Minimum	Maximum
	RT ¹	1.59	.567	1.47	.330	4.86
Switch	Proportion of Errors ²	.076	.090	.042	.000	.510
	RT ¹	1.13	.391	1.04	.330	4.12
No Switch	Proportion of Errors ²	.052	.094	.015	.000	.580

Note.

¹Reaction times (RTs) tended to be longer during switch trials when compared to no-switch trials.

²Error rates were higher during switch trials when compared to no-switch trials.

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table C.2b

Descriptive Statistics for Measures of the Letter-Digit Classification Task During Mixed Trials Grouped by Worldviews

	Dependent Variable	Mean	Std. Deviation	Median	Minimum	Maximum
Localised	RT ^{switch}	1.62	.567	1.50	.330	4.86
	Proportion of Errors ^{switch}	.069	.085	.041	.000	.510
	RT ^{no switch}	1.13	.381	1.03	.330	2.71
	Proportion of Errors ^{no switch}	.043	.085	.015	.000	.500
Orthodox	RT ^{switch}	1.49	.536	1.44	.600	3.51
	Proportion of Errors ^{switch}	.102	.119	.054	.00	.400
	RT ^{no switch}	.996	.261	.942	.610	1.84
	Proportion of Errors ^{no switch}	.093	.121	.015	.000	.360
Pragmatist	RT ^{switch}	1.58	.437	1.46	.950	2.65
	Proportion of Errors ^{switch}	.075	.089	.040	.000	.360
	RT ^{no switch}	1.16	.332	1.10	.700	2.19
	Proportion of Errors ^{no switch}	.055	.090	.015	.000	.420
Reward	RT ^{switch}	1.61	.771	.144	.600	4.75
	Proportion of Errors ^{switch}	.071	.086	.041	.000	.450

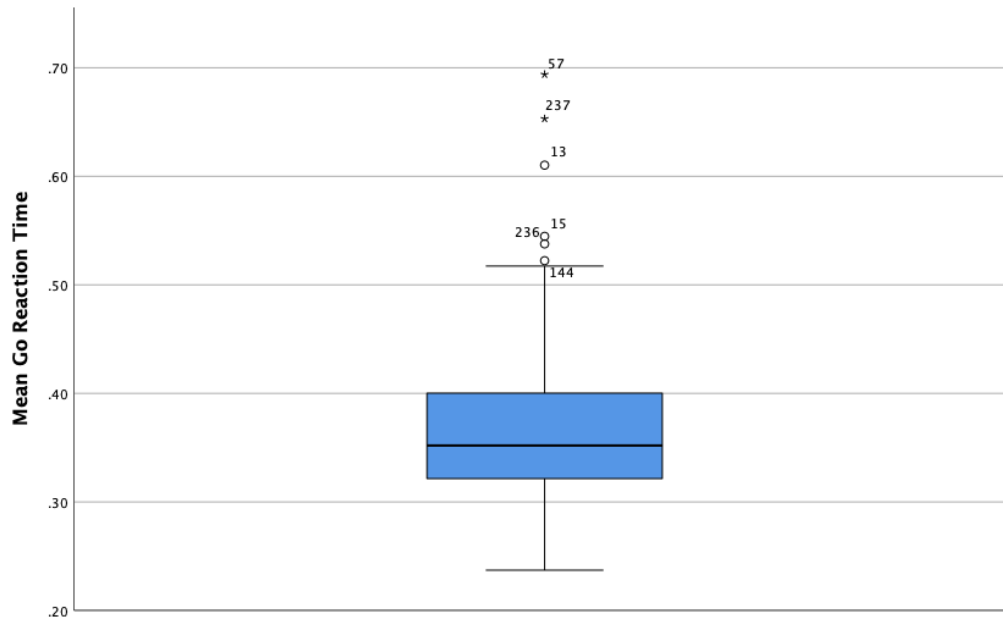
INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

	RT ^{no switch}	1.19	.601	1.05	.620	4.12
	Proportion of Errors ^{no switch}	.042	.101	.015	.000	.580
Survivor	RT ^{switch}	1.57	.455	1.53	.880	2.64
	Proportion of Errors ^{switch}	.091	.094	.055	.000	.330
	RT ^{no switch}	1.12	.286	1.08	.790	1.67
	Proportion of Errors ^{no switch}	.066	.100	.029	.000	.370

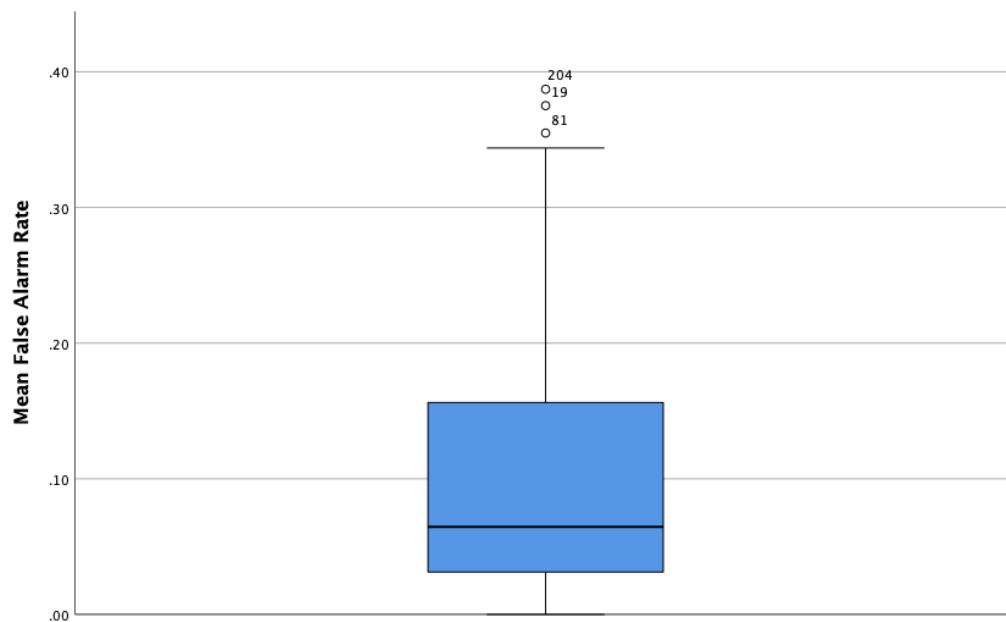
INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure C.1

Boxplot Displaying the Mean Go Reaction Time During the Go/No-Go Task

**Figure C.2**

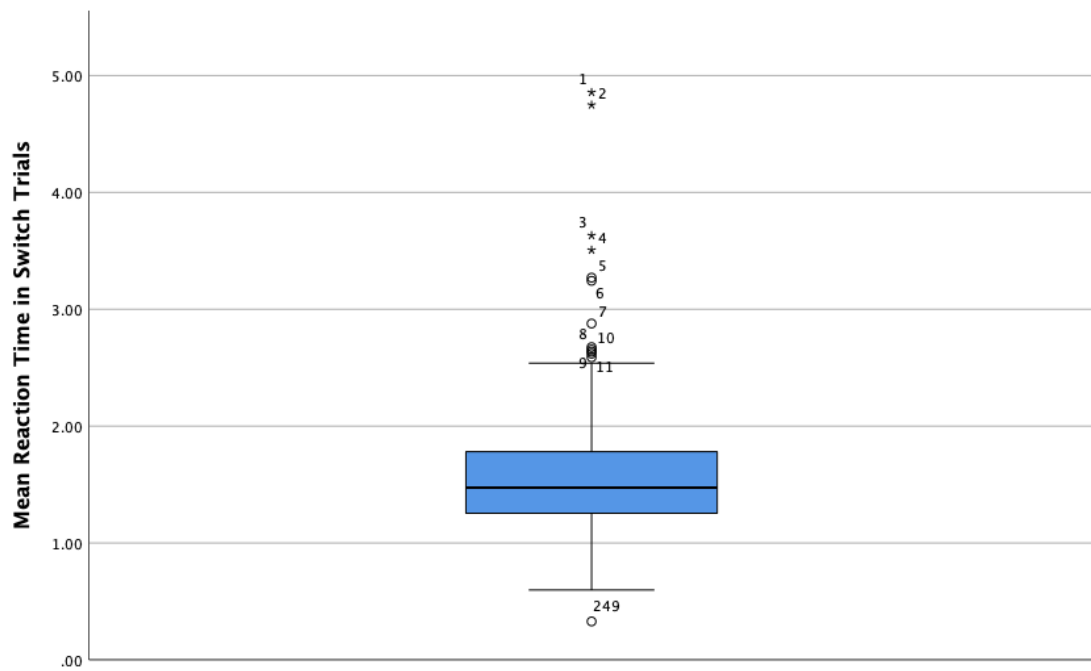
Boxplot Displaying the Mean False Alarm Rate During the Go/No-Go Task



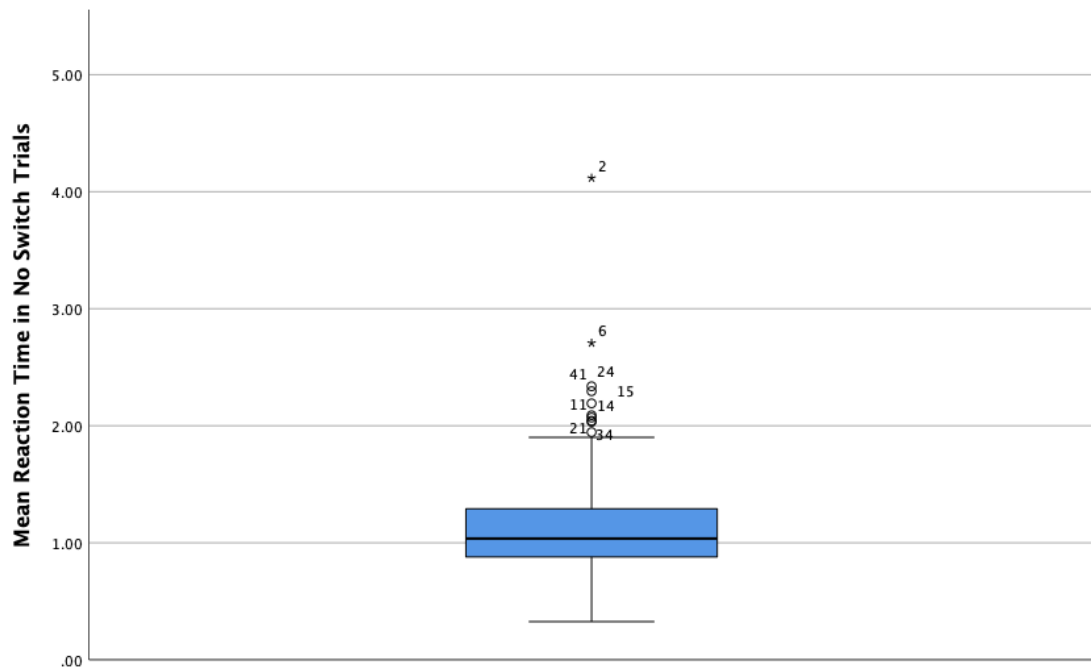
INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure C.3

Boxplot Displaying the Mean Reaction Time in Switch Trials During the Letter-Digit Classification Task

**Figure C.4**

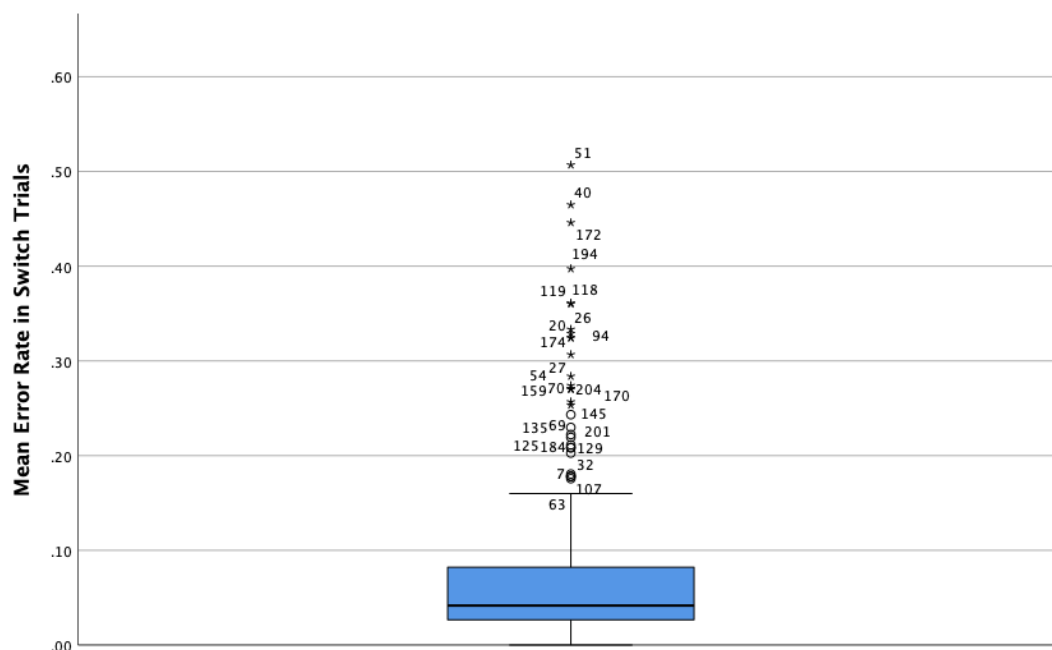
Boxplot Displaying the Mean Reaction Time in No Switch Trials During the Letter-Digit Classification Task



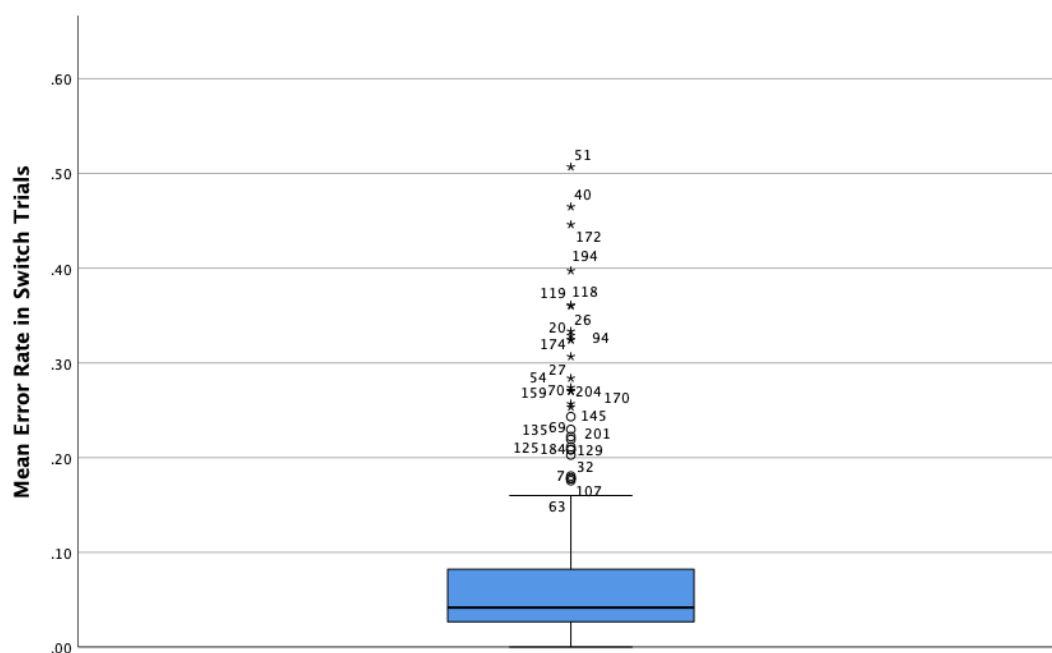
INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure C.5

Boxplot Displaying the Mean Error Rate in Switch Trials During the Letter-Digit Classification Task

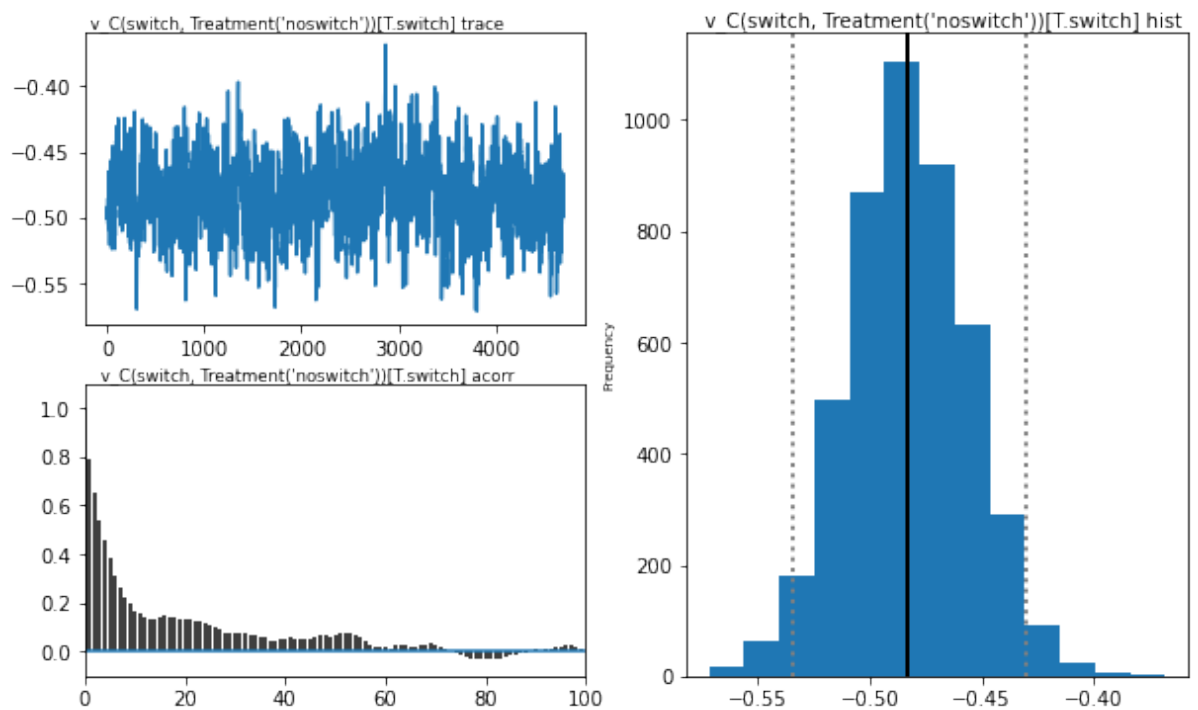
**Figure C.6**

Boxplot Displaying the Mean Error Rate in No Switch Trials During the Letter-Digit Classification Task



Appendix D**HDDM Analyses****Figure D.1**

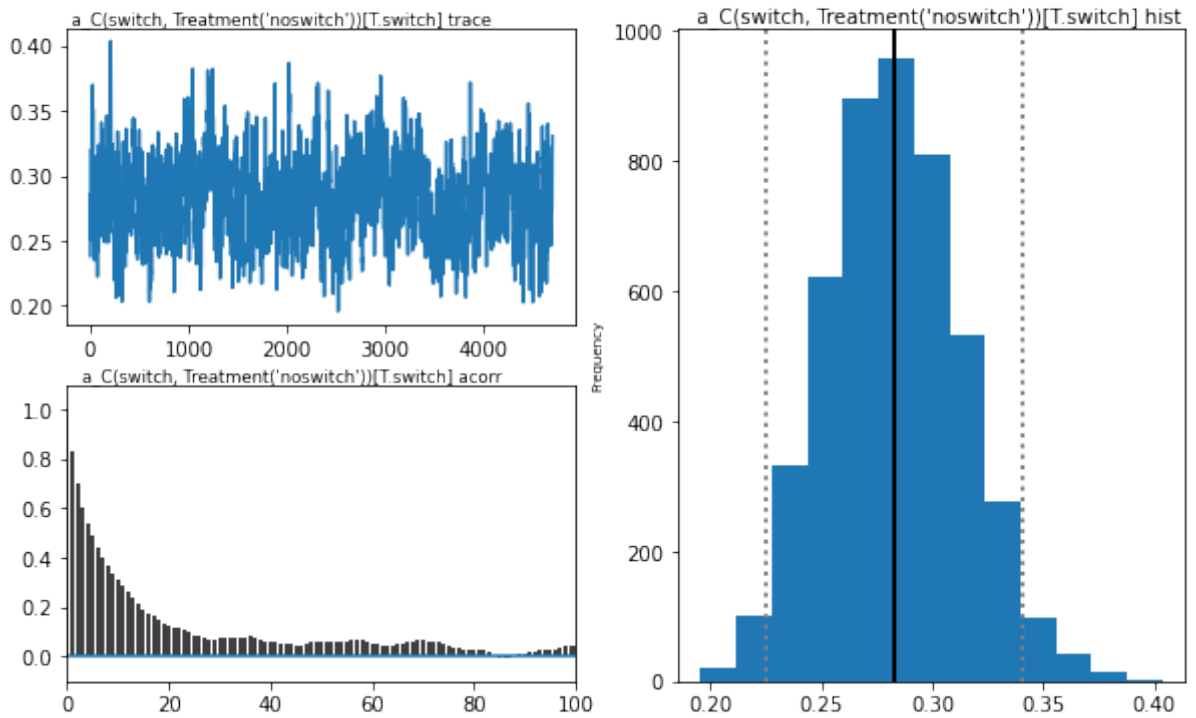
Drift Rate Traces, Autocorrections, and Histogram of the Localised Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.2

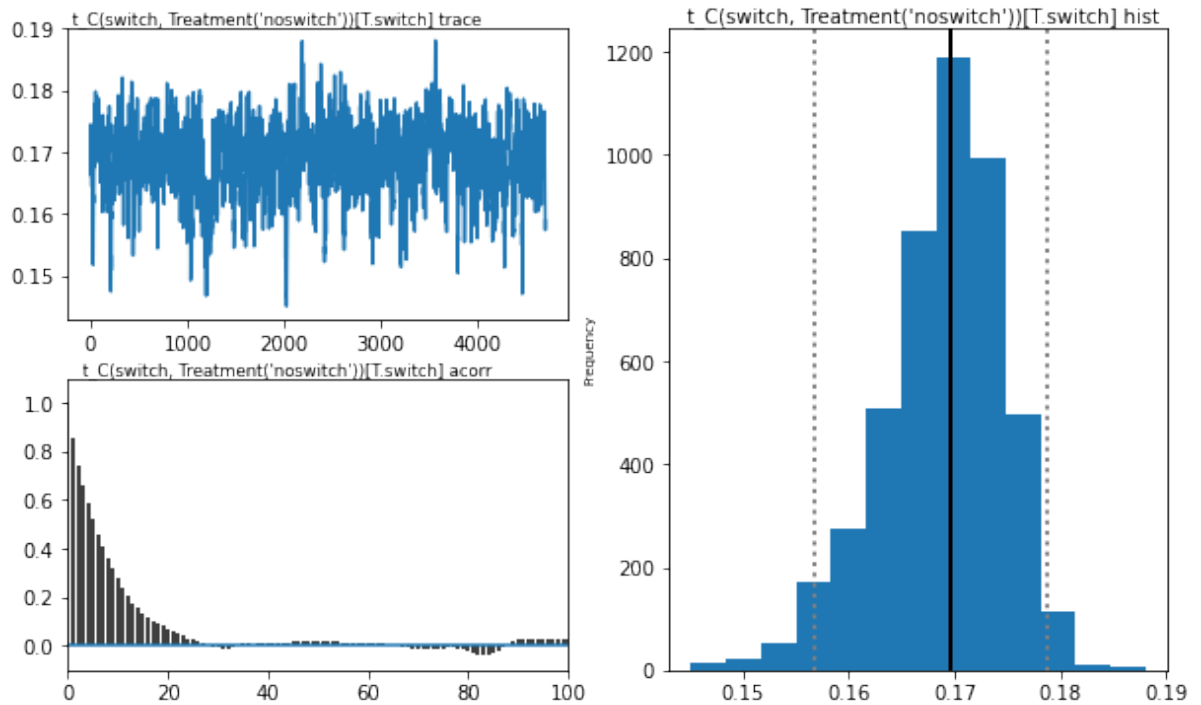
Threshold Traces, Autocorrections, and Histogram of the Localised Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.3

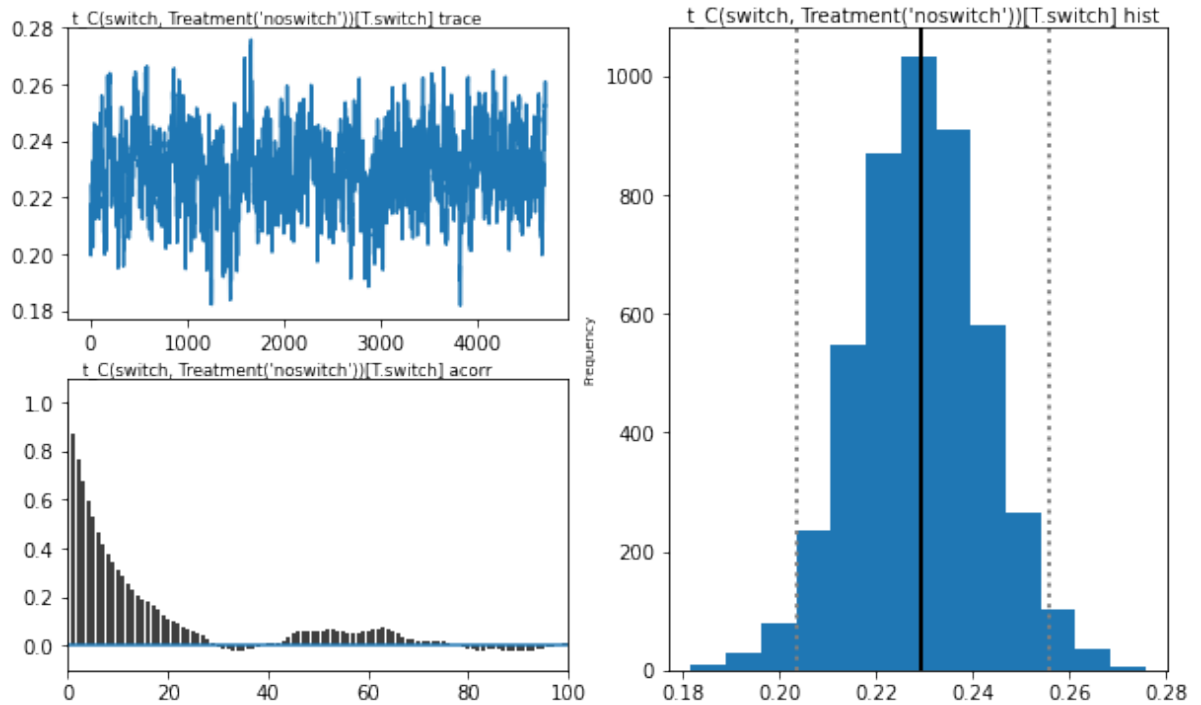
Non-Decision Time Traces, Autocorrections, and Histogram of the Localised Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.4

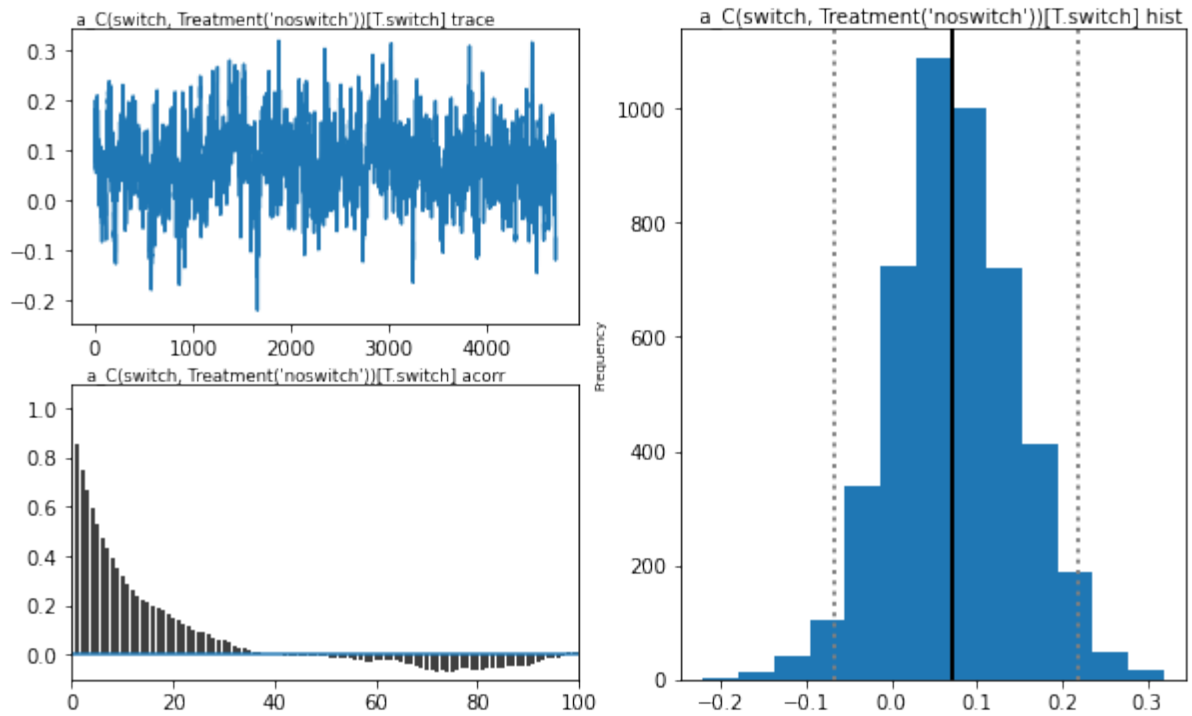
Drift Rate Traces, Autocorrections, and Histogram of the Orthodox Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.5

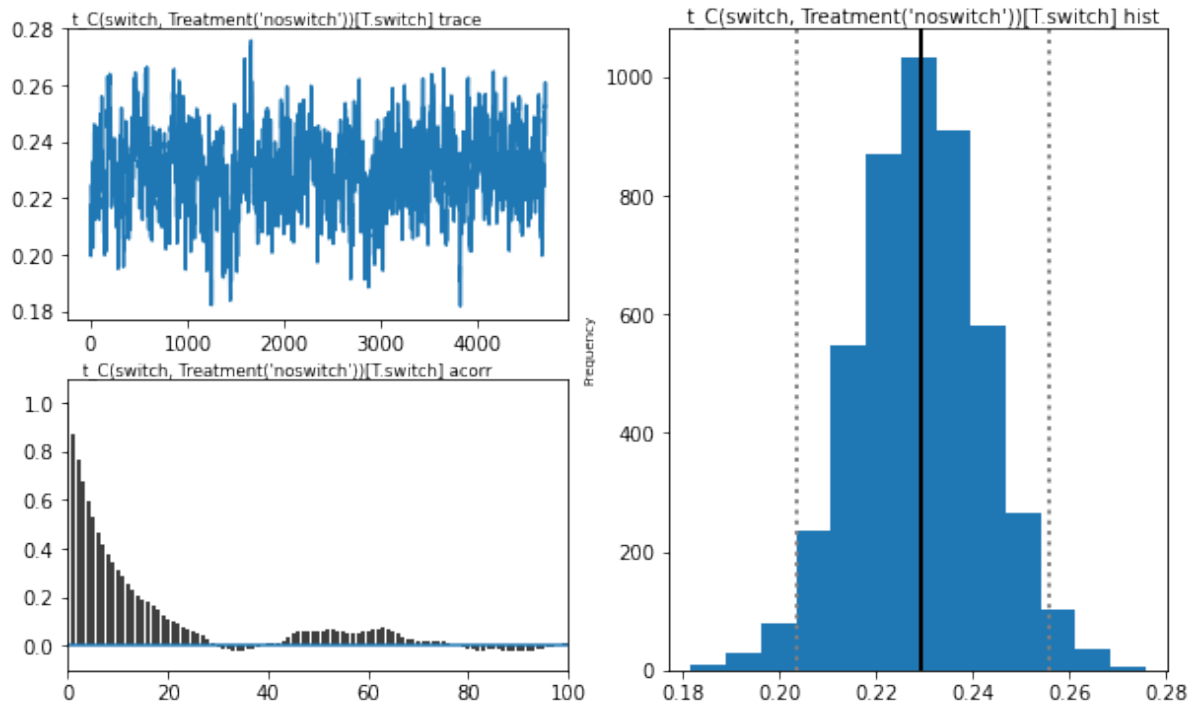
Threshold Traces, Autocorrections, and Histogram of the Orthodox Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.6

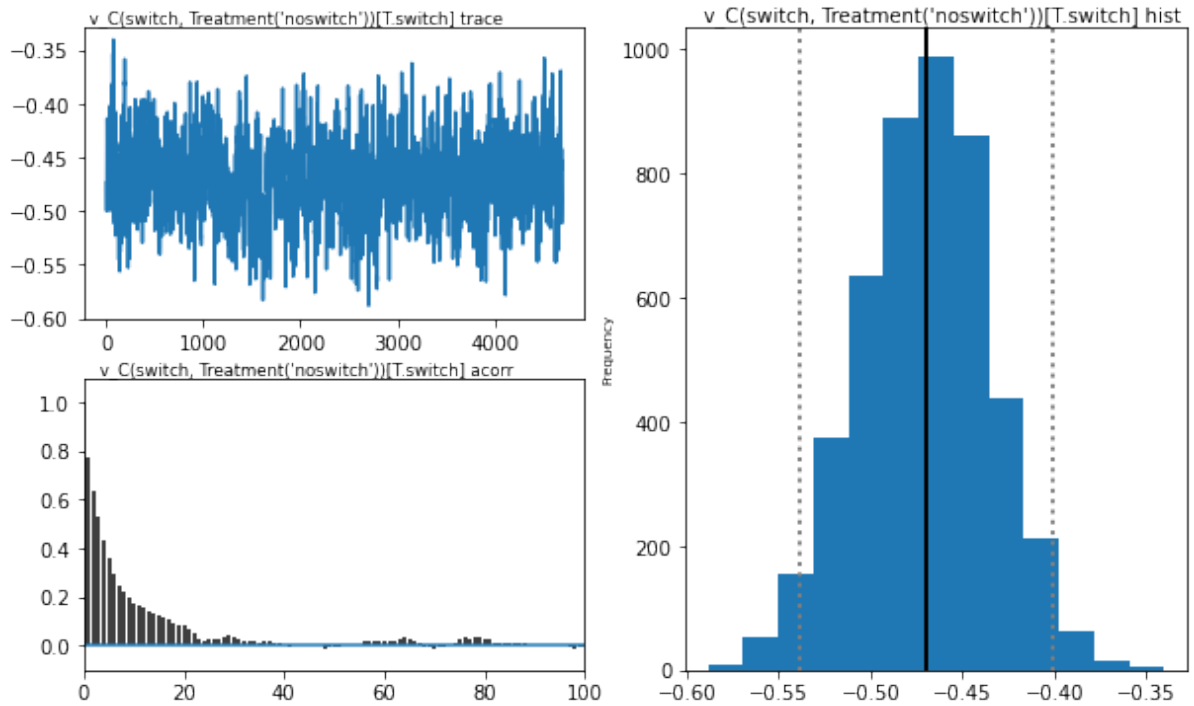
Non-Decision Time Traces, Autocorrections, and Histogram of the Orthodox Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.7

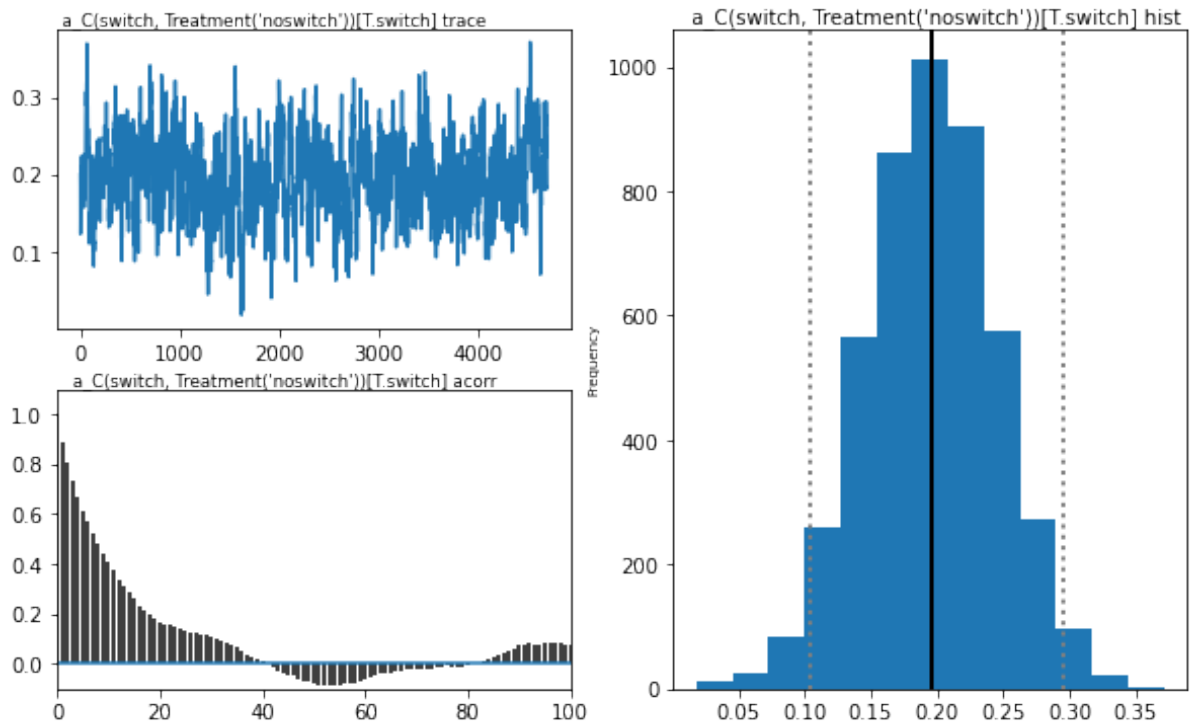
Drift Rate Traces, Autocorrections, and Histogram of the Pragmatist Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.8

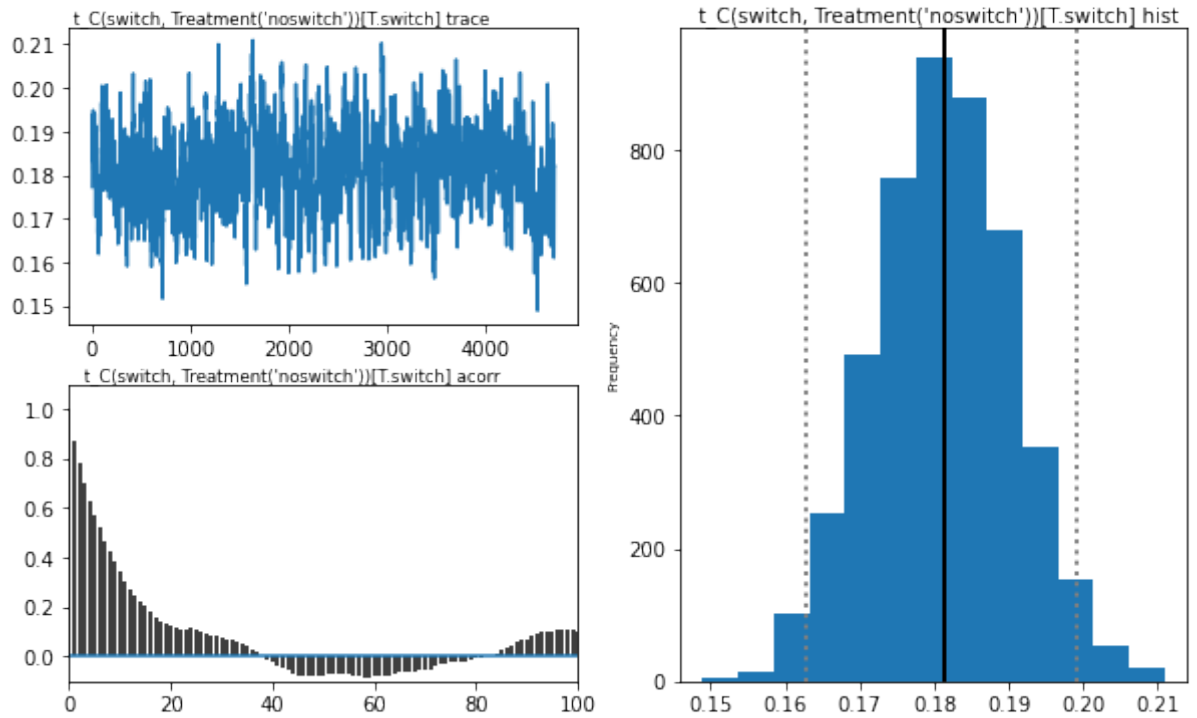
Threshold Traces, Autocorrections, and Histogram of the Pragmatist Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.9

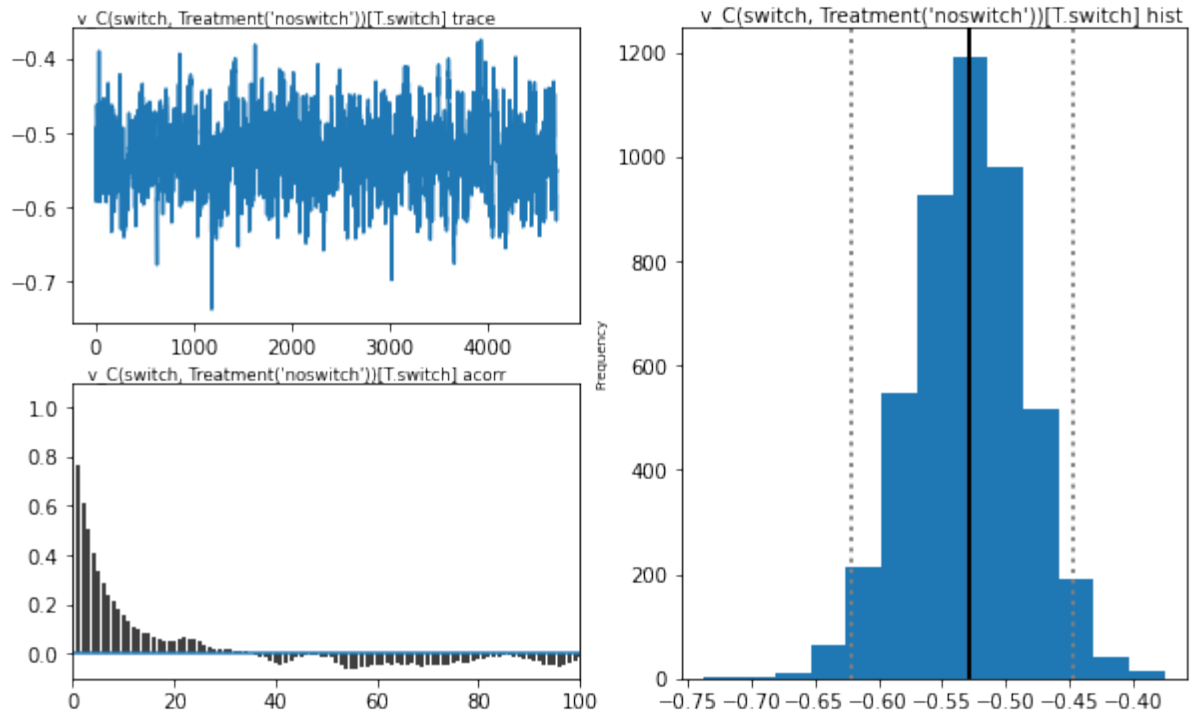
Non-Decision Time Traces, Autocorrections, and Histogram of the Pragmatist Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.10

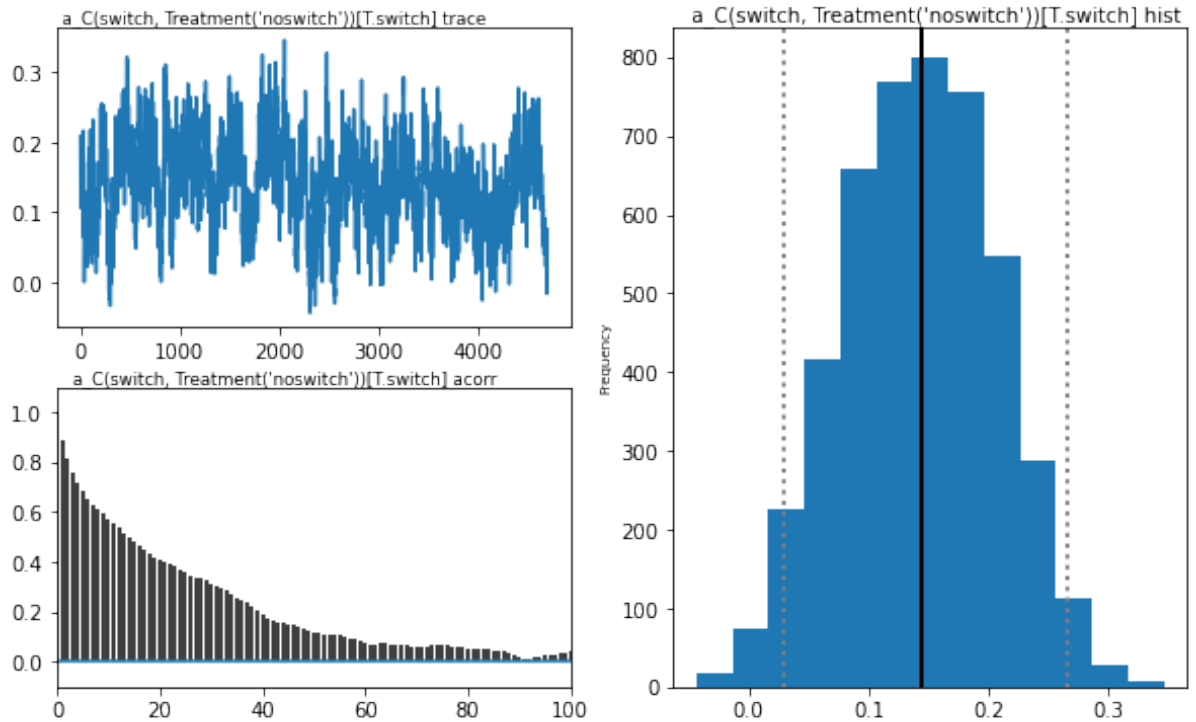
Drift Rate Traces, Autocorrections, and Histogram of the Reward Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.11

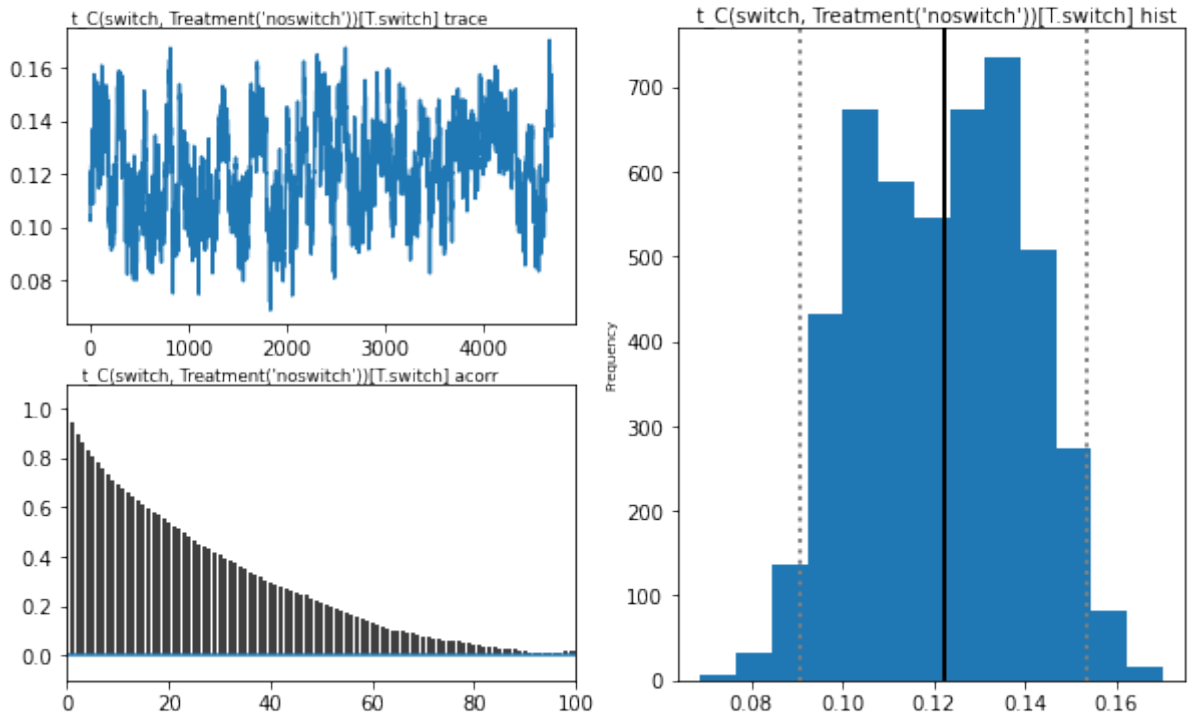
Threshold Traces, Autocorrections, and Histogram of the Reward Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.12

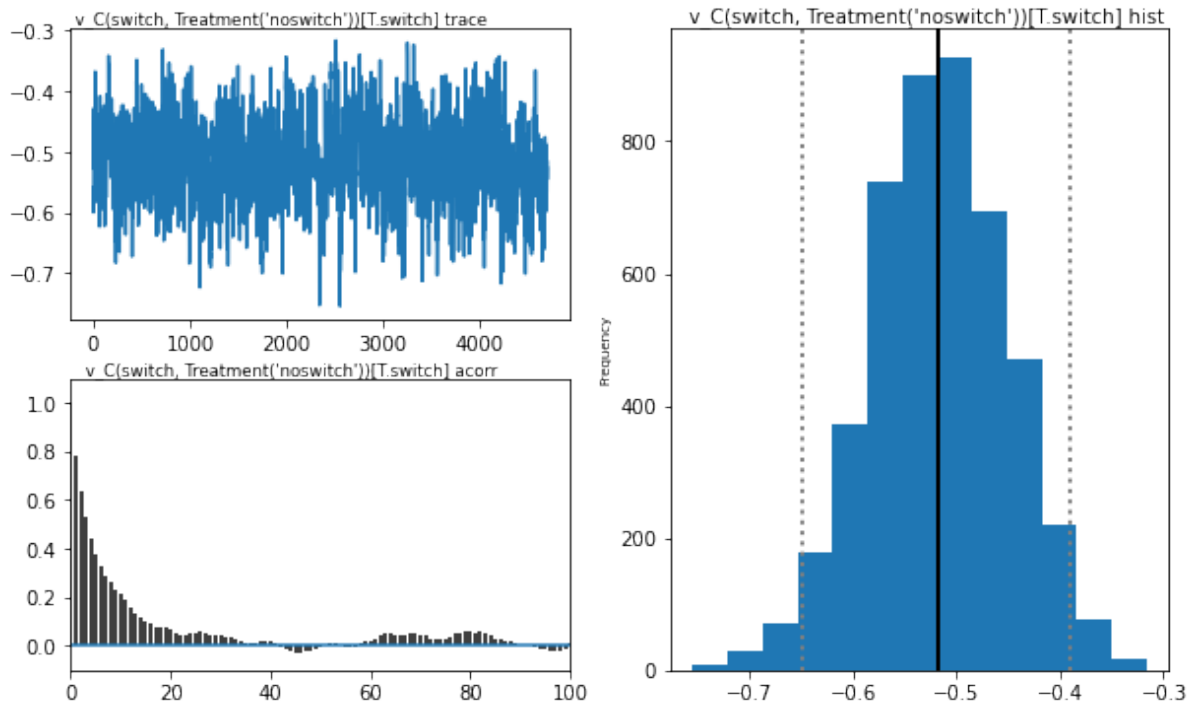
Non-Decision Time Traces, Autocorrections, and Histogram of the Reward Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.13

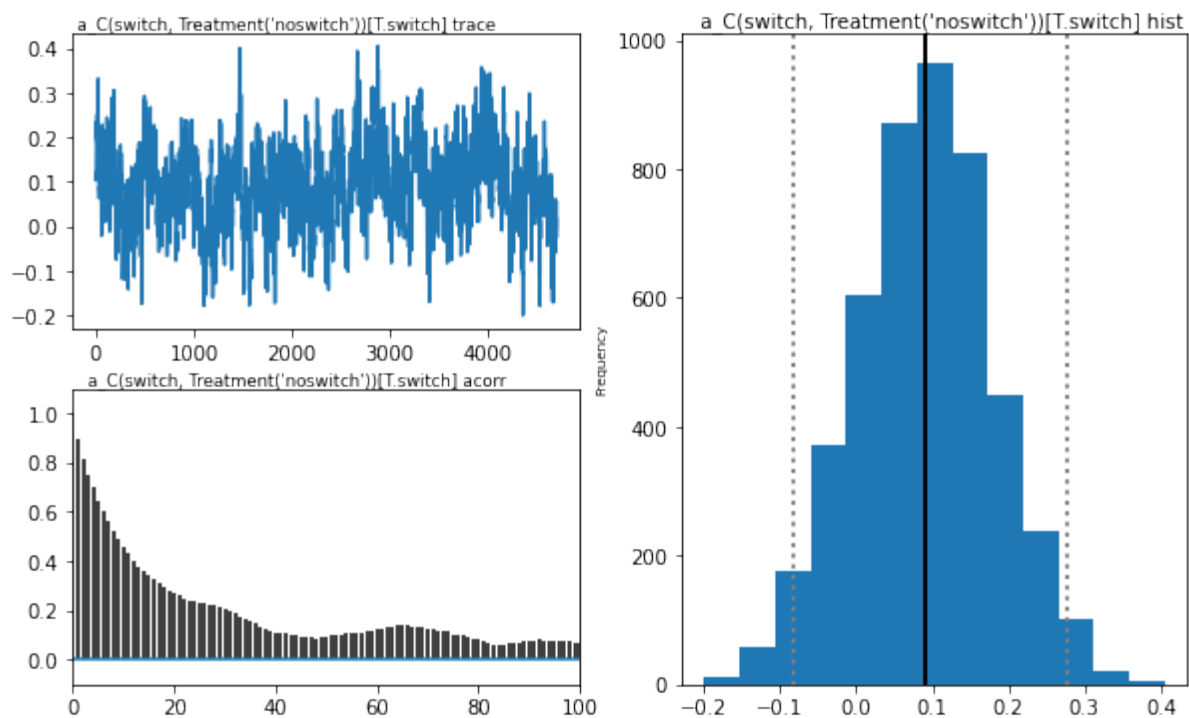
Drift Rate Traces, Autocorrections, and Histogram of the Survivor Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.14

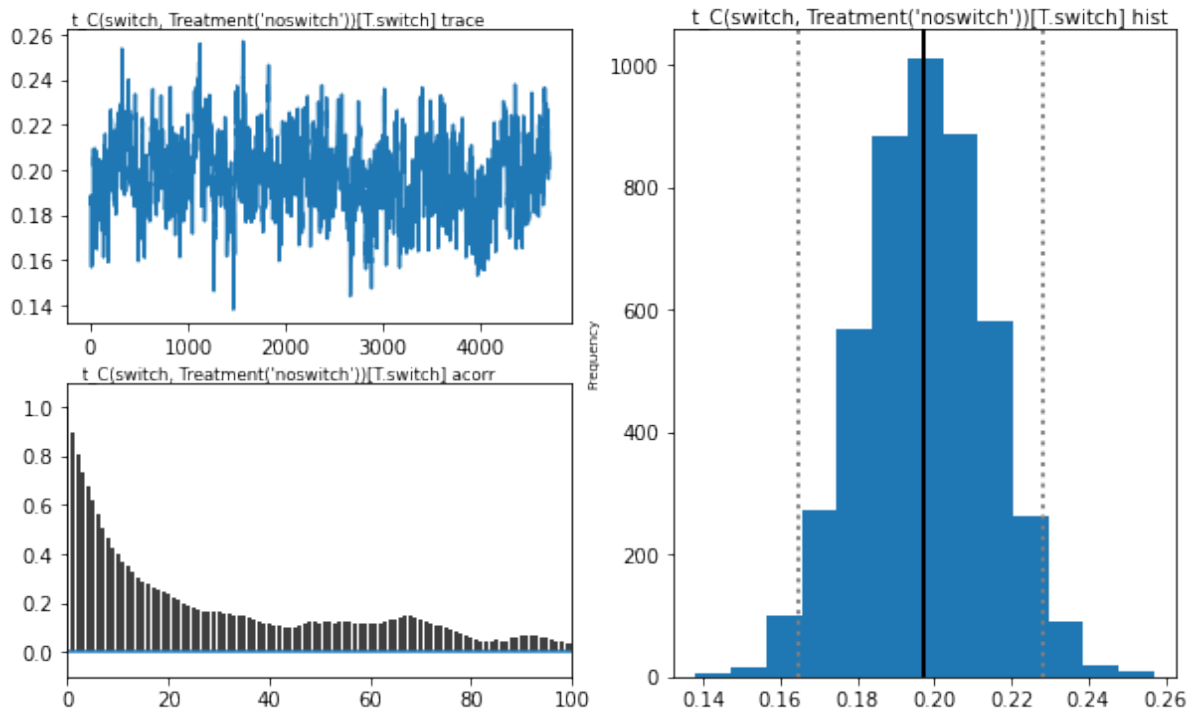
Threshold Traces, Autocorrections, and Histogram of the Survivor Worldview During a Switch



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Figure D.15

*Non-Decision Time Traces, Autocorrections, and Histogram of the Survivor
Worldview During a Switch*



INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table D.1*Posterior Predictive Checks for the Localised Worldview*

stat	observe					credibl e	quantil e	mahalanobi s
	d	mean	std	SEM	MSE			
accuracy	0.935	0.951	0.081	0.000	0.007	TRUE	18.572	0.197
mean_u								
b	1.421	1.289	0.336	0.017	0.130	TRUE	71.812 100.00	0.393
std_ub	5.593	0.586	0.259	25.073	25.141	FALSE	0	19.306
10q_ub	0.657	0.720	0.164	0.004	0.031	TRUE	33.172	0.386
30q_ub	0.870	0.934	0.210	0.004	0.048	TRUE	39.148	0.308
50q_ub	1.104	1.144	0.274	0.002	0.077	TRUE	51.567	0.147
70q_ub	1.431	1.432	0.382	0.000	0.146	TRUE	57.755	0.003
90q_ub	2.229	2.030	0.643	0.039	0.453	TRUE	69.904	0.309
mean_lb	-1.310	-1.260	0.535	0.003	0.289	TRUE	35.870	0.094
std_lb	1.182	0.404	0.402	0.605	0.767	TRUE	95.520	1.936
10q_lb	0.523	0.895	0.444	0.139	0.336	TRUE	10.730	0.839
30q_lb	0.779	1.025	0.457	0.061	0.270	TRUE	29.269	0.539
50q_lb	1.021	1.167	0.507	0.021	0.278	TRUE	45.909	0.288
70q_lb	1.374	1.366	0.613	0.000	0.376	TRUE	60.953	0.012
90q_lb	2.327	1.709	0.878	0.382	1.152	TRUE	81.908	0.704

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table D.2*Posterior Predictive Checks for the Orthodox Worldview*

stat	observe					credibl e	quantil e	mahalanobi s
	d	mean	std	SEM	MSE			
accuracy	0.935	0.942	0.123	0.000	0.015	TRUE	14.409	0.063
mean_u								
b	1.421	1.181	0.242	0.058	0.116	TRUE	88.791 100.00	0.991
std_ub	5.593	0.522	0.218	25.717	25.764	FALSE	0	23.298
10q_ub	0.657	0.665	0.130	0.000	0.017	TRUE	41.191	0.067
30q_ub	0.870	0.869	0.151	0.000	0.023	TRUE	47.682	0.005
50q_ub	1.104	1.057	0.191	0.002	0.039	TRUE	63.055	0.245
70q_ub	1.431	1.311	0.273	0.014	0.089	TRUE	71.664	0.438
90q_ub	2.229	1.840	0.494	0.151	0.396	TRUE	84.873	0.787
mean_lb	-1.310	-1.307	0.476	0.000	0.227	TRUE	42.800	0.007
std_lb	1.182	0.394	0.393	0.619	0.774	TRUE	95.584	2.001
10q_lb	0.523	0.946	0.391	0.179	0.332	TRUE	7.632	1.084
30q_lb	0.779	1.080	0.394	0.091	0.246	TRUE	16.690	0.763
50q_lb	1.021	1.222	0.446	0.040	0.239	TRUE	35.018	0.449
70q_lb	1.374	1.416	0.554	0.002	0.308	TRUE	55.061	0.076
90q_lb	2.327	1.748	0.841	0.334	1.041	TRUE	79.770	0.688

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table D.3*Posterior Predictive Checks for the Pragmatist Worldview*

stat	observe					credibl e	quantil e	mahalanobi s
	d	mean	std	SEM	MSE			
accuracy	0.935	0.958	0.065	0.001	0.005	TRUE	17.190	0.367
mean_u								
b	1.421	1.288	0.287	0.018	0.100	TRUE	75.129 100.00	0.466
std_ub	5.593	0.557	0.200	25.358	25.397	FALSE	0	25.210
10q_ub	0.657	0.742	0.163	0.007	0.034	TRUE	29.574	0.523
30q_ub	0.870	0.950	0.197	0.007	0.045	TRUE	38.097	0.409
50q_ub	1.104	1.152	0.244	0.002	0.062	TRUE	48.910	0.194
70q_ub	1.431	1.426	0.322	0.000	0.104	TRUE	59.155	0.014
90q_ub	2.229	1.994	0.518	0.055	0.323	TRUE	73.048	0.454
mean_lb	-1.310	-1.266	0.456	0.002	0.210	TRUE	37.284	0.096
std_lb	1.182	0.374	0.347	0.653	0.773	TRUE	97.265	2.326
10q_lb	0.523	0.928	0.405	0.164	0.329	TRUE	5.368	1.001
30q_lb	0.779	1.050	0.408	0.074	0.240	TRUE	22.777	0.665
50q_lb	1.021	1.183	0.442	0.026	0.221	TRUE	41.711	0.366
70q_lb	1.374	1.365	0.520	0.000	0.270	TRUE	59.597	0.016
90q_lb	2.327	1.680	0.737	0.418	0.961	TRUE	83.541	0.877

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table D.4*Posterior Predictive Checks for the Reward Worldview*

stat	observe						mahalanobi	
	d	mean	std	SEM	MSE	credible	quantile	s
accuracy	0.935	0.910	0.127	0.001	0.017	TRUE	30.976	0.194
mean_u								
b	1.421	1.322	0.458	0.010	0.219	TRUE	69.061	0.217
std_ub	5.593	0.630	0.351	24.636	24.759	FALSE	100.000	14.155
10q_ub	0.657	0.728	0.197	0.005	0.044	TRUE	34.642	0.363
30q_ub	0.870	0.938	0.273	0.005	0.079	TRUE	43.806	0.252
50q_ub	1.104	1.157	0.367	0.003	0.137	TRUE	50.527	0.143
70q_ub	1.431	1.465	0.516	0.001	0.268	TRUE	56.630	0.066
90q_ub	2.229	2.117	0.881	0.012	0.788	TRUE	65.079	0.127
mean_lb	-1.310	-1.305	0.658	0.000	0.433	TRUE	37.907	0.008
std_lb	1.182	0.491	0.483	0.476	0.710	TRUE	93.742	1.428
10q_lb	0.523	0.863	0.456	0.116	0.324	TRUE	13.540	0.745
30q_lb	0.779	1.013	0.511	0.055	0.316	TRUE	33.735	0.457
50q_lb	1.021	1.181	0.607	0.026	0.394	TRUE	47.882	0.263
70q_lb	1.374	1.425	0.770	0.003	0.596	TRUE	59.163	0.066
90q_lb	2.327	1.867	1.126	0.211	1.479	TRUE	76.976	0.408

INDIVIDUAL DIFFERENCES IN SELF-REGULATORY ABILITIES

Table D.5*Posterior Predictive Checks for the Survivor Worldview.*

stat	observe					credibl e	quantil e	mahalanobi s
	d	mean	std	SEM	MSE			
accuracy	0.935	0.962	0.059	0.001	0.004	TRUE	17.300	0.474
mean_u								
b	1.421	1.210	0.216	0.045	0.091	TRUE	81.600 100.00	0.978
std_ub	5.593	0.522	0.182	25.718	25.752	FALSE	0	27.811
10q_ub	0.657	0.697	0.111	0.002	0.014	TRUE	37.350	0.366
30q_ub	0.870	0.896	0.135	0.001	0.019	TRUE	46.360	0.196
50q_ub	1.104	1.084	0.175	0.000	0.031	TRUE	57.810	0.113
70q_ub	1.431	1.340	0.247	0.008	0.069	TRUE	66.710	0.367
90q_ub	2.229	1.872	0.433	0.127	0.314	TRUE	77.550	0.824
mean_lb	-1.310	-1.266	0.439	0.002	0.195	TRUE	38.016	0.100
std_lb	1.182	0.340	0.343	0.708	0.825	FALSE	97.652	2.455
10q_lb	0.523	0.958	0.422	0.190	0.368	TRUE	5.074	1.031
30q_lb	0.779	1.071	0.411	0.085	0.254	TRUE	19.447	0.710
50q_lb	1.021	1.191	0.431	0.029	0.215	TRUE	39.609	0.395
70q_lb	1.374	1.360	0.495	0.000	0.245	TRUE	59.582	0.028
90q_lb	2.327	1.643	0.698	0.467	0.955	TRUE	84.669	0.979