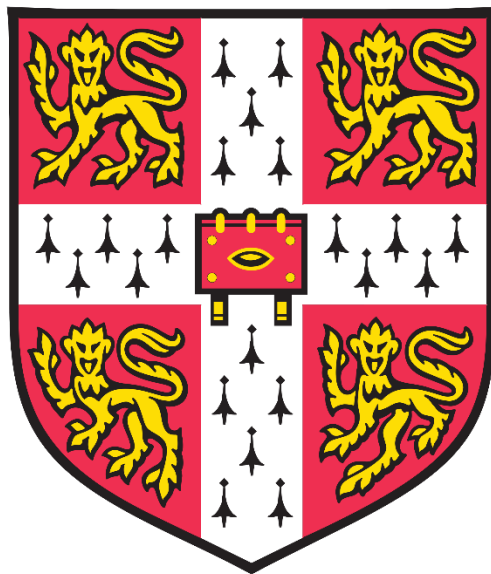


# The Cognitive Underpinnings of Ideological Thinking

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Downing College  
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May 2019

*This dissertation is submitted for the degree of Doctor of Philosophy.*



## Declaration

This thesis is the result of my own work and includes nothing which is the outcome of work done in collaboration except as declared in the Preface and specified in the text. It is not substantially the same as any that I have submitted, or, is being concurrently submitted for a degree or diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. I further state that no substantial part of my thesis has already been submitted, or, is being concurrently submitted for any such degree, diploma or other qualification at the University of Cambridge or any other University or similar institution except as declared in the Preface and specified in the text. It does not exceed the prescribed word limit for the relevant Degree Committee

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# The Cognitive Underpinnings of Ideological Thinking

Leor Zmigrod

## Summary

The collective ideologies of the 20<sup>th</sup> and 21<sup>st</sup> century have illustrated the horrifying scale of human atrocities that can be committed in the name of ideological groups and causes. While philosophers and historians have developed rich accounts of the societal factors shaping the forces behind participation in collective ideologies, there has been remarkably little rigorous scientific investigation into the cognitive and neural factors that can increase an individual's susceptibility to ideological dogmatism and extremism. The aim of the current doctoral research was therefore to examine what psychological traits make some individuals more vulnerable to ideological thinking than others.

Theory-driven and data-driven approaches were employed to map out the cognitive underpinnings of ideological thinking. A series of large online studies encompassing over 1,500 participants revealed that ideological rigidity may be rooted in cognitive rigidity, such that the rigidity with which individuals process and evaluate neutral stimuli predicts the rigidity and extremity of their ideological beliefs. This relationship was corroborated across multiple ideological domains, including nationalism, religion, political partisanship, dogmatism, and extremist attitudes, uncovering a tight link between low-level perceptual processes and high-level ideological attitudes.

Furthermore, a data-driven approach using Bayesian analyses was adopted to study the cognitive and personality signatures of political conservatism, nationalism, religiosity, and dogmatism. This exposed that psychological dispositions can predict ideological attitudes substantially better than traditional demographic variables, challenging the dominant perspective in the social sciences that socioeconomic indicators are the most powerful predictors of how citizens vote and what they believe.

This research program therefore suggests that ideological attitudes are amenable to careful cognitive and computational analysis. The findings signify that individual differences in our cognitive dispositions may underpin the intensity of our ideological adherence – and so a rigorous scientific study of the ideological mind may illuminate pertinent societal questions facing modern democracies.

“So long as you write what you wish to write, that is all that matters; and whether it matters for ages or only for hours, nobody can say.”

Virginia Woolf, *A Room of One's Own* (1929)

“To listen to a symphony, one doesn't situate oneself among the brass but in a place where the sounds of the diverse instruments blend in the way the composer wanted them to. After that one could enjoy dissecting the score, note by note, and in doing so study the manner of its orchestration. In the same way, in front of a divided picture, it will be advisable first to stand far enough away to perceive the impression of the whole, then stop and come closer to study the play of coloured elements.”

Paul Signac, *From Eugène Delacroix to Neo-Impressionism* (1899)





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The freedom to think, write, experiment, and grow is perhaps the most profound and rare privilege one could possess – and I have been incredibly lucky to experience it during the three years of this doctoral program. But, I know that my luck is the product of the hard work, trust, and support of many people, and so I'd like to thank them briefly below.

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# 1

## Chapter 1

### Introduction



# 1 Introduction

## 1.1 A Cognitive Lens on Ideologies

Since the birth of modern civilization, humans have been creating stories that capture their theories about how the world works and how they should act within this complex world. These narratives both describe and prescribe human action, and exist in a kaleidoscope of forms – from religious doctrines to political manifestos, and from racial supremacy to authoritarian nationalism. These accounts are broadly termed “ideologies”, and envelope humans’ personal and social lives to a considerable degree. The Pew Research Centre estimates that 84.4% of people affiliate with a religious institution<sup>1</sup>, and the International Institute for Democracy and Electoral Assistance approximates that over 1.3 billion people voted in their local parliamentary elections across the world between 2016 and 2019<sup>2</sup>. Exposure to and participation in collective ideologies is therefore remarkably prevalent and consequential to people’s daily lives.

The psychological and societal ramifications of widespread engagement in ideologies are highly multifaceted. On one hand, ideologies confer a sense of meaning and social connectedness to a community of fellow believers (Hogg, 2005, 2014). On the other hand, ideologies have also given rise to history’s gravest atrocities; people are often willing to kill and die in the name of an ideological cause, and to take extreme measures to defend a cherished ideal or community (Swann et al., 2009, 2014; Whitehouse & Lanman, 2014; Whitehouse, 2018). The pervasive nature of these behaviours has motivated substantial theorising on their origin: scholars of philosophy, history, and politics have long sought to identify the forces shaping the emergence and adoption of ideologies. Early theories developed in the social sciences will therefore serve as a critical foundation upon which the present research will build.

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<sup>1</sup> Data can be found at:

[http://globalreligiousfutures.org/explorer#/?subtopic=15&chartType=pie&year=2020&data\\_type=percentage&religious\\_affiliation=all&destination=to&countries=Worldwide&age\\_group=all&gender=all&pdfMode=false](http://globalreligiousfutures.org/explorer#/?subtopic=15&chartType=pie&year=2020&data_type=percentage&religious_affiliation=all&destination=to&countries=Worldwide&age_group=all&gender=all&pdfMode=false)

<sup>2</sup> Data can be found at: <https://www.idea.int/data-tools/question-view/441>

Specifically, there are two striking – and often understated – observations that guided the present research. Firstly, social scientists have frequently noted that not all individuals are equally likely to internalize ideologies and adhere to them in an extreme fashion. In their pioneering book, *The Authoritarian Personality*, Adorno and colleagues (1950) asked “why is it that certain individuals accept [fascist] ideas while others do not?” (p. 3). Soon afterwards, in 1955, psychologist Richard Crutchfield posed a similar question about conformity: “what traits of character distinguish between those [people] exhibiting much conformity behaviour... and those exhibiting little conformity?” (Crutchfield, 1955, p. 194). Building on these ideas, the sociologist Edward Shils noted that individuals are differentially susceptible to ideological doctrines, and that this is not purely a matter of upbringing or socioeconomic context: “not all those who live in a broken and disadvantaged condition are drawn equally by the magnet of the ideological orientation” (Shils, 1958, p. 463-464). Social psychologist Thomas Blass further highlighted the presence of interpersonal variation in ideological and authoritarian processes; “that there are individual differences in obedience is a fact because in most obedience studies, given the same stimulus situation, one finds both obedience and disobedience taking place” (Blass, 1991, p. 402). Early social psychological theorising therefore hypothesized the existence of individual difference factors that may amplify individuals’ susceptibility to ideological processes.

The second critical observation is that diverse, and sometimes opposing, ideologies use strikingly similar tools and mechanisms to inculcate their followers and galvanize them towards collective action and self-sacrifice (Hoffer, 1951). All ideologies, regardless of their doctrine or ambition, possess two essential qualities. Firstly, all ideologies embrace some form of *rigid dogma* or at least a simple premise that assumes the existence of one true explanation of – and corresponding solution to – existing societal conditions. These accounts frequently possess a compelling logic, if the premises are believed (Arendt, 1951). All ideologies therefore enforce a sharp distinction between those in possession of the ideology’s truth and those who are not and espouse categorical divisions between what constitutes “good” versus “evil” and who belongs to the ideological ingroup (“us”) and who does not (“them”). As



sociologist Edward Shils suggested in 1958, “the belief of those who practice politics ideologically [is] that they alone have the truth about the right ordering of life – of life as a whole, and not just of political life” (Shils, 1958, p. 451). Ideologies thus breed rigidity and dogmatism about truth, morality, and identity. Secondly, all ideologies invent and adopt clear *identity markers*, such as flags, symbols, anthems, costumes, and rituals, which signal membership and devotion. The shared and visible nature of these identity markers foster passionate feelings of immersion and connectedness with the ideological group. Indeed, people are often prepared to kill and die over a flag or a defaced ideological symbol (Whitehouse et al., 2014; Swann et al., 2010a, 2010b). By dispensing clear guidelines for what to believe and how to act, as well as offering a group to which one can belong, ideologies resolve feelings of uncertainty and rootlessness (Hogg, 2014; Jost, 2017; Kruglanski et al., 2014, 2017).

These common tools of ideological indoctrination – rigid dogma and identity markers – can be found consistently across the spectrum of ideological persuasions. From fascism and communism to radical eco-activism and religious evangelism, ideological groups offer absolute answers to societal troubles, strict rules for behaviour, and an ingroup mentality through dedicated practices and symbols. These mechanisms are further facilitated and amplified by propaganda (Holbig, 2013), systems of punishment for deviance and disbelief (Boyd, Gintis, Bowles, & Richerson, 2003; Fehr & Gächter, 2002; Schweitzer, 1962), and familial and kinship metaphors which are often used to depict fellow comrades as “sisters and brothers-in-arms”, religious leaders as “mothers and fathers”, the nation as the “motherland” or “fatherland”, and revolutionaries as the “sons and daughters” of ideological causes (Whitehouse & Lanman, 2014). These characteristics emerge even when the ideology is guided by the sincerest intentions and ideals, and allow ideologies to endow followers with a sense of coherence, belonging, meaning, and identity that is tightly intertwined with their attachment to the ideological group.

The current research therefore built on the observations that (1) individuals vary in their susceptibility to ideological doctrines and processes, and (2) that there is remarkable uniformity in the composition and consequences of diverse ideologies. It

sought to examine what individual differences make people susceptible to thinking in ideologically rigid ways, regardless of the content of that ideology. Rather than focusing on *socioeconomic* predictors, as has been done in the past (e.g. Brown-Iannuzzi, Lundberg, & McKee, 2017; Jetten, Haslam, & Barlow, 2013), it emphasized *psychological* predictors. And instead of investigating *one* specific ideological domain (e.g. politics or religion), it examined the correlates of a *multitude* of ideologies. The research program detailed and developed in the following pages thereby emerged from one primary question: *What psychological traits make some individuals more susceptible to joining ideological groups and adhering to ideological doctrines than others?*

What do we mean by “ideology”? While ideology has been defined in the past in myriad ways (for a useful review see Jost, Federico, & Napier, 2009), such as a “system of beliefs” (Converse, 1964) or an “organization of opinion, attitudes, and values – a way of thinking about man and society” (Adorno et al., 1950, p. 2), here we are concerned with a more specific phenomenon. An ideology, in the sense evaluated here, possesses two characteristics. Firstly, it has a *doctrinal* component, reflected in a doctrine composed of a set of descriptive and prescriptive attitudes about social relations and norms. In other words, an ideology constitutes prescriptions for how people ought to think, behave, and interact. Secondly, an ideology entails a *relational* component, in which there is strong ingroup favouritism towards other adherents of the ideology coupled with distrust towards outgroups<sup>3</sup>. These structural components can become psychological: *Ideological thinking* can therefore be defined as a style of thinking that is rigid in its adherence to a doctrine and resistance to belief-updating (i.e. doctrinal), and oriented towards an ingroup and antagonistic to outgroups (i.e. selectively relational)<sup>4</sup>. There is both interpersonal and intrapersonal variation in the

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<sup>3</sup> These two components map on roughly (but not exactly) to a distinction made in political science between issue-based (operational) political ideology and identity-based (symbolic) ideology (Ellis & Stimson, 2012; Mason, 2018). Issue-based (operational) ideology can be thought of as the component of political ideologies concerned with policy attitudes (Free & Cantril, 1967). Identity-based (symbolic) ideology reflects the social connection to groups that hold particular ideological labels, such as “liberal” and “conservative” (Levitin & Miller, 1979).

<sup>4</sup> Importantly, throughout the dissertation, the term “ideological” refers both to the property of being associated with an ideological doctrine (in the traditional sense) and to the property of having the doctrinal and relational/parochial characteristics of ideologies as defined here.

intensity and manifestation of individuals' ideological thinking, signifying that we can study the emergence of ideological worldviews across and within individuals.

Rich lines of inquiry in social psychology have been established to try to unpack the complex processes by which individuals transition from exposure to an ideological doctrine to devout participation and adherence. Nonetheless, the study of ideology is marked by substantial balkanization. There is now a psychology of politics (Jost et al., 2003a), of religion (Norenzayan, 2013), of nationalism (Anderson, 1983; Billig, 1995), of prejudice (Brandt, 2017; Duckitt & Sibley, 2009), of dehumanization (Haslam, 2006), of obedience (Haslam & Reicher, 2007; Reicher & Haslam, 2011), of collective action (van Zomeren, Postmes, & Spears, 2008), of conspiracy theories (Douglas, Sutton, & Cichocka, 2017; van Prooijen & Van Vugt, 2018), of radicalization (Kruglanski et al., 2014) - but there isn't an overarching psychology of ideology.

The reasons for this fractionation are historical, methodological, and conceptual, and perhaps all can be traced to a theoretical interest in the *content* of ideological beliefs rather than the *structure* of ideological thinking. In other words, researchers have focused on asking why individuals believe specific ideological claims (such as about the presence of omniscient gods or capitalistic worldviews), rather than why ideological attitudes - regardless of their content - are so compelling to the human mind and pervasive across civilizations. An emphasis on the content of ideological beliefs justifies the existing academic landscape, in which each ideological domain merits its own discipline of study. In contrast, a theoretical and empirical focus on the processes of ideological immersion invites a holistic, interdisciplinary outlook that addresses the commonalities across diverse ideologies.

To ground the present research in previous findings and theoretical frameworks, the following subsections will (1) offer a brief review of the psychology of ideology (Section 1.2), (2) evaluate the conceptual and methodological challenges and gaps in the literature (Section 1.3), (3) outline the theory-driven component of this doctoral research, specifically the *cognitive rigidity hypothesis of ideology* (relevant to Chapters 2-5; Section 1.4), and (4) delineate the data-driven methods employed to study the cognitive underpinnings of diverse ideological attitudes (relevant to

Chapter 6; Section 1.5). This will set the stage for the research program sparked by the quest to answer these historical, and yet highly modern and topical, questions.

## **1.2 The History of the Study of Ideology**

### **1.2.1 *Philosophical and Psychological Beginnings (19<sup>th</sup> and 20<sup>th</sup> Century)***

The study of ideology has a rich history that spans philosophy, history, political science, sociology, anthropology, and psychology, and has been continuously informed by political and societal events (Durrheim, 1997). Perhaps one of the earliest modern philosophers to write about the dangers of ideologies was the German existentialist philosopher, Friedrich Nietzsche. Nietzsche distinguished between “the man of convictions” and “the man of scientific thinking” (1878/2008, p. 40), whereby he defined a conviction as “the belief that in some point in knowledge one possesses absolute truth” (1878/2008, p. 40). He proposed that a conviction therefore holds three problematic assumptions: (1) “that absolute truths exist”, (2) “that the perfect methods for arriving at them have been found”, and (3) “that every man who has convictions makes use of these perfect methods” (Nietzsche, 1878/2008, p. 40). By delineating the relationship between convictions and dogmatic thinking, as well as how these are antithetical to evidence-based scientific thinking, Nietzsche argued that “convictions are more dangerous enemies of truth than lies” (Nietzsche, 1878/2008, p. 1). He noted that “it is not the struggle of opinions that has made history so violent, but rather the struggle of belief in opinions, that is, the struggle of convictions” (Nietzsche, 1878/2008, p. 41). The existentialist philosopher thus set in motion a rich line of philosophical inquiry into the ways in which dogmas, mass movements, and ideologies can lead to the erosion of reason and individual freedom. This was further advanced and articulated by the founder of psychoanalysis Sigmund Freud (1921) in *Group Psychology and the Analysis of the Ego*, by the feminist existentialist philosopher Simone de Beauvoir in *The Ethics of Ambiguity* (1948), by the political philosopher Hannah Arendt (1951) in *The Origins of Totalitarianism*, and by the thinker Eric Hoffer in *The True Believer* (1951), amongst others.

With respect to 20<sup>th</sup> century psychology<sup>5</sup>, the early writings on the psychology of collective ideologies can be traced – as with almost any subdiscipline of psychology – to William James. The prolific psychologist set out a vision for the birth of the psychology of religion in *The Varieties of Religious Experience* (James, 1902), in which he posited that it is possible to study religion in a rigorous analytical fashion. To illustrate this, James invoked the Enlightenment thinker Baruch Spinoza’s words, “I will analyse the actions and appetites of men as if it were a question of lines, of planes, and of solids” (Spinoza, 1677/2017). Spinoza here suggests that human behaviours, thoughts, and desires are amenable to quantitative analysis and a scientific approach. James went even further to advocate that despite the variability of religious doctrines<sup>6</sup>, their commonalities may be the most fascinating objects of study: “When we survey the whole field of religion, we find a great variety in the thoughts that have prevailed there; but... the theories which Religion generates, being thus variable, are secondary; and if you wish to grasp her essence, you must look to the feelings and the conduct as being the more constant elements” (James, 1902, p. 650). William James thereby recommended a focus on the implicit and unconscious common elements evident across religious (and other) ideologies, preceding Sigmund Freud’s thinking on the relationships between belief and the unconscious by at least 20 years.

Half a century later, with a similar vision to William James, the thinker Eric Hoffer (1951) wrote expansively about the importance of considering the structural and psychological essence of ideologies, rather than focusing on their content. Writing about the processes shaping the rise of mass movements, Hoffer noted in *The True Believer* that “when people are ripe for a mass movement, they are usually ripe for any effective movement, and not solely for one with a particular doctrine or program” (Hoffer, 1951, p. 16). Hoffer tapped into a critical idea: individual-level risk factors for ideological thinking may be domain-general and not specific to a particular doctrine. That is, the psychological factors that make an individual susceptible to religious

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<sup>5</sup> As opposed to philosophy, wherever a distinction can be meaningfully made.

<sup>6</sup> Although William James explicitly refers to religion, he does include a variety of ideologies as exemplars, which may today be thought of as philosophical or spiritual positions, such as Stoicism and Buddhism.

doctrines are remarkably similar to those that make them vulnerable to communist ideologies or far-right ideologies or radical social justice ideologies.

Despite the prominence of the idea that the *way* in which an ideology compels the mind is at least as psychologically (and philosophically) interesting as its idiosyncratic doctrine – an argument evident in the writings of Nietzsche, James, and Hoffer – it faded in the second half of the 20<sup>th</sup> century. Historically, this may have been due to the powerful influence of the Holocaust on social psychology, which provoked renowned American psychologists to focus on the origins of fascism and right-wing authoritarianism. The emphasis of Adorno, Frenkel-Brunswik, Levinson, and Sanford's (1950) *The Authoritarian Personality* on the psychology of the political *right* had a lasting impact on the development of political psychology, which continued to concentrate on explaining political conservatism, authoritarianism, and anti-minority prejudice, while largely overlooking left-wing authoritarianism and other ideological realms such as nationalism, patriotism, and extreme social and environmental justice activism.

Social psychology between the 1950s and 1970s made significant advances in our understanding of intergroup dynamics, and especially the psychological forces shaping conformity (Asch, 1956, Bond, 2005), obedience (Milgram, 1963; Reicher & Haslam, 2011; Reicher, Haslam, & Smith, 2012), social categorization (for reviews: Cikara, Bruneau, & Saxe, 2011; Cikara & Van Bavel, 2014; Diehl, 1990; Otten, 2016), collective action (Van Zomeren et al., 2008), and cognitive dissonance (Festinger & Carlsmith, 1959; Festinger, 1962). Nonetheless, it was characterized by a lack of integration across these foci of study and an absence of a clear framework that considered how all these processes jointly contribute to immersion, adherence, and radicalization to ideologies. The drive to uncover the psychological similarities of discrepant ideological domains that was present in the early 20<sup>th</sup> century was mostly lost by the late 20<sup>th</sup> century<sup>7</sup>. However, in its place, social psychologists continued to

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<sup>7</sup> Perhaps with the exception of terror management theory, which does posit that all ideologies and cultural worldviews serve similar defensive functions against existential threat (Greenberg, Pyszczynski, & Solomon, 1986).

be inspired by the Freudian idea that our behaviours and beliefs are guided by the pursuit of satisfying various needs, motivations, and desires. Consequently, a large proportion of 21<sup>st</sup> social psychology aimed to apply these Freudian principles to the question of why people believe in specific ideological doctrines.

### ***1.2.2 Freudian Artefacts: Motivational Accounts of Ideological Processes***

Prevailing theories of the psychology of various ideologies and associated processes, such as conservatism (Jost et al., 2003a), religious fundamentalism (Hill & Williamson, 2005), authoritarianism (Adorno et al., 1950), system-justification (Jost & Banaji, 1994), and violent radicalization (Kruglanski et al., 2014), have been explicitly *motivational* accounts. Motivations are frequently defined in this literature in terms of psychological processes that energize behaviour in the pursuit of attaining goals (mental representations of desired states). These include motives to satisfy basic biological and psychogenic needs such as nutrition, safety, and esteem (Maslow, 1943), as well as higher-order motives to achieve competence (Ryan & Deci, 2000), belonging (Fiske, 2010), control and coherence (Higgins, 2011). Theories of ideological behaviour in terms of its motivational origins can be traced to the Freudian influences on 20<sup>th</sup> century psychology, and in particular to Adorno and colleagues' (1950) pioneering book, *The Authoritarian Personality*. In accordance with Freudian and psychoanalytic thought, they defined personality as "essentially an organization of *needs...* (drives, wishes, emotional impulses)" (Adorno et al., 1950, p. 5). This provoked Adorno and colleagues (1950) to discuss susceptibility to ideologies in terms of needs and motivations: "ideologies have for different individuals, different degrees of appeal, a matter that depends upon the individual's needs and the degree to which these needs are being satisfied or frustrated" (Adorno et al., 1950, p. 2).

The language of needs and motivations has persisted as the primary lens through which ideological processes are discussed in the academic literature. This has had a powerful effect on how the psychological roots of ideologies have been

conceptualized, operationalized, and measured. Motivational theories have been particularly prominent in three relevant domains of social psychology: (1) social identity processes, (2) radicalization, and (3) political conservatism. With respect to social identity theories, multiple frameworks have been developed that posit that the need to reduce subjective uncertainty or threat motivates individuals to join social groups and defend their worldviews. This idea has been elaborated in Uncertainty Identity Theory (Hogg, 2007), the Uncertainty Management Model (Van den Bos, 2009), and Terror Management Theory (Pyszczynski et al., 1999), and supported by research illustrating that uncertainty can amplify social categorization and intergroup hostility (e.g. Grant & Hogg, 2012; Hogg et al., 2007; Reid & Hogg, 2005; Sherman, Hogg, & Maitner, 2009). Building on this literature, in the context of violent extremism, Kruglanski and colleagues (e.g. Kruglanski et al., 2009, 2013, 2014, 2017; Webber & Kruglanski, 2018) have suggested that radicalization is largely motivated by individuals' quest for personal significance, and that through the experience of social connectedness and adherence to violence-justifying ideologies, violent extremism can become a means to attain feelings of meaning and self-worth. Indeed, a fruitful line of research around Kruglanski's Significance Quest Theory has demonstrated the existence of a relationship between violent political behaviour and motivations to reduce feelings of meaninglessness, humiliation, and relative deprivation (e.g. Kruglanski et al., 2014; Adam-Troian et al., 2019). Within political psychology, Jost and colleagues (2003, 2017) have delineated three primary motivations that may be subjectively fulfilled by adopting conservative worldviews: (1) *epistemic* motives to attain coherence and certainty, (2) *existential* motives to experience safety and meaning, and (3) *relational* motives to feel socially connected with others.

Although Jost and colleagues' (2003, 2009, 2017) taxonomy was synthesized to account for right-wing political conservatism, it substantially overlaps with theories focusing on social identity processes and extremism. These similarities make the three-motive taxonomy a valuable classification of the psychological motivations that generally elevate the allure of salient ideological narratives. Indeed, epistemic motivations to build coherent models of the world and reduce uncertainty or ambiguity have been shown to play a role in nationalism (Hogg, Meehan, &



Farquharson, 2010; Hohman & Hogg, 2011), religious fundamentalism (Brandt & Reyna, 2010), conservatism (Jost, 2017), and radicalism (Hogg & Adelman, 2013). Similarly, the existential needs to attain subjective meaning and to solidify one's purpose in the world are manifest amongst those on the political extremes (Maher, Igou & Van Tilburg, 2018; Van Tilburg & Igou, 2016), and mortality salience manipulations can induce a conservative shift in political attitudes and greater support for militant or violent solutions (e.g. Hirschberger & Ein-Dor, 2006; Landau et al., 2004; Routledge, Roylance, & Abeyta, 2017). Lastly, relational motives to affiliate with others and establish interpersonal relationships have been implicated in ideological attachment to a variety of worldviews (Anicich, Fast, Halevy, & Galinsky, 2015; Baumeister & Leary, 1995; De Dreu, Balliet, & Halevy, 2014; Gebauer & Maio, 2012; Hennes, Nam, Stern, & Jost, 2012; Jost, 2017; Weise et al., 2008). Consequently, it is valuable to consider these three motivations as key predictors of individuals' susceptibility to joining ideological groups and movements regardless of the content of their ideological beliefs.

## **1.3 Gaps and Methodological Challenges in the Literature**

### **1.3.1 *Beyond Motivations: Cognitive Perspectives***

A fundamental insight that has emerged amongst cognitive scientists over the past 50 years is that individuals vary in the way in which their brains process information from the environment. When presented with identical stimuli, individuals will process and physiologically react to these stimuli in different ways, based on their cognitive and neural architecture (Posner & Rothbart, 2018; Sallis, Smith, & Munafò, 2018; Trofimova, 2016; Trofimova & Robbins, 2016; Trofimova, Robbins, Sulis, & Uher, 2018; Uher, 2018). Thus, there are *cognitive dispositions* – enduring biologically-based dispositional tendencies in processing, evaluating, and responding to stimuli – that guide individuals' behaviour and decision making. These cognitive dispositions are stable over time, typically not under explicit conscious control, and are manifest with regards to neutral non-emotional stimuli, as well as

emotionally-valenced stimuli (Trofimova et al., 2018). The robust cognitive scientific understanding that human behaviour is not solely determined by needs and motivations suggests that purely motivational accounts of the emergence and maintenance of ideological worldviews may be insufficient.

Incorporating modern conceptualizations of cognition into the study of ideological processes has been recognized as an important task for both scientific and non-scientific (political) reasons. Scientifically, an interest in the relationship between cognitive style and ideological attitudes can be traced to the early 20<sup>th</sup> century (for reviews see: Durrheim, 1997 and Van Hiel et al., 2016), and the growing knowledge that individual differences are not purely constrained to “needs” but can also be manifest in information processing tendencies has opened up an important avenue for study. Moreover, with the recent emergence of political neuroscience (Jost, Nam, Amodio, & Van Bavel, 2014), it is imperative to elucidate the mediating cognitive mechanisms that sit between ideological behaviour and neural activity. From a more politically-motivated perspective, Durrheim (1997) noted that numerous political critiques sought to use scientific evidence to legitimize the rationality of their ideology and denounce the supposedly inherent irrationality of others. Durrheim (1997) wrote that “if a direct relationship can be established between an irrational cognitive style and specific ideological beliefs, then these beliefs can be reproached on scientific grounds – as inaccurate, unsystematic, or inefficient. It may be argued that the ideology is an expression of a generalized psychological irrationality” (p. 630; also cited in Van Hiel et al., 2016). Political psychology as a field is still grappling with its political and societal implications and ambitions (Jost, 2017), but it is the hope that a cognitive and computational perspective to these questions will focus on developing mechanistic accounts of ideological cognition rather than politically-motivated denunciations of particular doctrines. Section 1.5 will discuss how novel methodological and analytic techniques from cognitive science can help alleviate motivated scientific reasoning and hypothesis generation.

### *1.3.2 Measuring Cognitive Dispositions and Style - Past Methodological Weaknesses*

Despite the manifest importance of developing an understanding of the intersections between cognitive and ideological processes, there has been remarkably little integration between cognitive psychology and social psychology on these questions. Notably, the motivational frameworks advocated by social and political psychology are not only conceptual: they possess associated epistemological assumptions and methodological practices that centre on quantifying psychological traits using self-report assessments. This differs from the cognitive literature's development of performance-based, objective, implicit tasks designed to assess cognitive traits such as inhibition, metacognition, working memory capacity, cognitive flexibility, and others. Consequently, the methods that have been used to assess "cognitive style" in social psychology have often failed to correspond to those developed by the neuropsychological literature.

In particular, political psychologists have often operationalized "cognitive style" in terms of self-report motivational measures, such as need for cognitive closure (Webster & Kruglanski, 1997) and need for cognition (Cacioppo & Petty, 1982). Both need for cognitive closure and need for cognition have been extensively studied in relation to right-wing attitudes (NCC: Chirumbolo, 2002; Cornelis & Van Hiel, 2006; Crowson, Thoma, & Hestevold, 2005; Jost et al., 2003a; Kimmelmeier, 1997; Kossowska & Van Hiel, 2003; Van Hiel, Pandelaere, & Duriez, 2004; NC: Sargent, 2004; Hennes, Nam, Stern & Jost, 2012; Crowson, 2009; Feldman & Johnston, 2014; Ksiazkiewicz, Ludeke, & Krueger, 2016). This has led many social and political psychologists to claim that their studies evaluate the "cognitive" basis of political beliefs, despite the significant limitations of these measures (discussed at greater length in Chapter 4).

The discrepancy between the social and cognitive psychological operationalization of cognition has significant implications for the nature of findings in this realm. In fact, in a meta-analysis by Van Hiel and colleagues (2016) spanning 103 samples and over 12,000 participants, the authors found that relationships

between measures of cognitive style and right-wing attitudes were larger when the study used a self-report measure rather than a behavioural measure of cognitive style. This suggests that effect sizes may be inflated as a result of divergent operationalizations and an insufficient attention to the cognitive literature. Moreover, given that ideological orientations are also self-reported, overreliance on self-report measures of “cognition” can induce issues of common method variance. Therefore, theoretic and empirical advancement of the field requires a careful examination of the role of methodological and terminological considerations in established findings in this discipline.

### **1.3.3 *Disentangling Cognition, Motivation, and Personality***

Importantly, there are essential and notable distinctions between cognitive dispositions and motivations. Firstly, while motivations are malleable across contexts within the same individual, cognitive dispositions reflect relatively stable individual differences. Moreover, while individuals can have conscious access to their needs and motivations, and so can self-report their motivational states, cognitive dispositions are implicit and frequently can only be shown via behavioural tasks that are designed to tap into these specific cognitive processes. Methodologically, there is therefore a sharp distinction between how we should measure cognitive dispositions and motivations: while the former is assessed via established neuropsychological tasks, the latter is measured through self-report questionnaires or experimental paradigms that elicit certain motivational states (see Table 1.1).

**Table 1.1.** Definitions of key terms.

<b>Term</b>	<b>Definition</b>	<b>Stability of Construct</b>	<b>Assessment Method</b>	<b>Assessment Example</b>
<b>Cognitive Disposition</b>	An individual's enduring biologically-based tendencies in processing, evaluating, and responding to stimuli.	Stable	Cognitive behavioural test (outcome measures include reaction times, accuracy rates, switch costs, or DDM parameter estimates)	Go/No Go Task N-Back Task Wisconsin Card Sorting Test
<b>Personality</b>	An individual's profile of enduring behavioural patterns of interaction with the environment, in intrapersonal and interpersonal contexts.	Stable	Self-report personality measure targeting common behaviours, values, and preferences	Ten-Item Personality Inventory
<b>Motivation</b>	The set of psychological processes that energize behaviour in the pursuit of attaining goals (mental representation of desired states). Motivations vary in content, arousal, direction, intensity, and persistence and guide attention, effort, and commitment.	Flexible	Self-report test of motivation  Activation of motivations by experimental means	Need for Cognitive Closure  Need for Cognition
<b>Ideology / Ideological Orientation</b>	A set of descriptive and prescriptive attitudes about social relations or norms (how people ought to think, behave, and interact), coupled with strong favouritism of a social group of adherents.	Stable in short-term/ Flexible in long-term	Self-report measure of values, beliefs, and attitudes or assessment of behaviour in intergroup contexts	Nationalism Religiosity Conservatism Authoritarianism
<b>Ideological Thinking</b>	Thinking that is rigid (strictly adherent to an implicit or explicit dogma) and group-oriented (selectively oriented towards an ingroup and antagonistic to outgroups)	Stable/ Flexible	Measured by ideological orientation measures (above)	

One may ask, where does “personality” reside amongst these definitions? Here we define personality in terms of an individual’s profile of enduring behavioural patterns of interaction with the environment in intrapersonal and interpersonal contexts (Goldberg, 1993; John & Gosling, 2000; McCrae & John, 1992). Personality can be manifest in common behaviours and preferences that the individual is consciously aware of. Personality overlaps with cognitive dispositions in that it taps into stable individual differences. However, an individual’s personality is critically different to their cognitive dispositions in that the former is consciously-accessible while the latter is not, and personality operates at a higher-order level of interpersonal behaviours while cognitive dispositions are evident in lower-level information processing of stimuli (and affect downstream behaviour as a consequence). Naturally, personality and cognitive dispositions are related: our conscious behaviours and preferences are shaped by how we process information from the environment. Nonetheless, it is a matter of empirical inquiry to determine how biologically-based cognitive dispositions shape the manifestation of personality. An assumption that the two constructs are equal will only be to the detriment of psychological research by provoking unnecessary conflation of terms, constructs, and theories.

Furthermore, personality differs from motivation. While this definitional distinction may run counter to Freudian-inspired psychology, it is imperative to clarify the discrepancies and overlaps. As defined earlier, while motivations constitute sets of psychological processes that energize behaviour in pursuit of particular goals, and so motivations can be made salient or silent, personality reflects enduring characteristics that are largely stable over time scales. Whereas an individual’s motivations can differ in intensity, arousal, persistence, and influence over behaviour throughout the lifespan, personality traits are conceptualized as largely remaining uniform in how they shape and underpin action and decision-making (e.g. Caspi, Roberts, & Shiner, 2005; Costa & McCrae, 1997; Harris, Brett, Johnson, & Deary, 2016; Johnson, McGue, & Krueger, 2005; McCrae & Costa, 1994). Despite these differences, personality and motivation are tightly interlinked. Some personality traits may elevate the chronic experience of certain motivations, or one’s susceptibility to temporary activation of motivational states. Moreover, since personality reflects enduring

tendencies of behaviour and preferences, and motivations are strongly intertwined with preferences, it is reasonable for there to be significant overlap in how these constructs are operationalized.

Indeed, methodologically, there has often been confusion regarding what constitutes a cognitive disposition, a personality trait, or a motivational state. Identical scales have been used for all three categories. For example, the scale “need for cognitive closure” (NCC) has been simultaneously labelled a measure of “cognitive style”, “epistemic motivation”, and a “cognitive-motivational content independent construct” (Chirumbolo, 2002; Cornelis et al., 2008). In their early research on the need for cognitive closure scale, Webster and Kruglanski (1997) suggest that NCC may emerge from an interaction of cognitive capacity and motivation. Regrettably, contemporary research on instruments such as need for cognition, need for cognitive closure, need for order and structure, need for certainty and security, are often used interchangeably as “personality”, “motivations”, and “cognitive dispositions”. It is hoped that clarifying the differences between these three constructs will facilitate more appropriate design and implementation of assessment tools in future research.

#### ***1.3.4 Measuring Ideology – Assessment Challenges***

Perhaps most bizarrely, and problematically, dispositions and motivations have often been confounded with ideology itself. Various scales that ostensibly measure ideological orientation, such as right-wing authoritarianism (RWA) and social dominance orientation (SDO), are sometimes conceptualized as enduring personality variables, sometimes as motivations, sometimes as sets of specific beliefs, and sometimes as general ideological-intergroup orientations. Even the psychologists who first popularized these constructs wrote about authoritarianism and SDO in ambiguous terms: Altemeyer (1988) considered right-wing authoritarianism as a “personality variable” (p. 3), and Sidanius and Pratto (2001) thought of SDO simultaneously as a motive - a “ubiquitous motive driving most group-relevant social attitudes” (p. 57; also cited in Reynolds et al., 2007) – and as an ideological worldview: a “general attitudinal orientation toward intergroup relations, reflecting whether one generally prefers such relations to be equal, versus hierarchical” (Pratto et al., 1994, p.

742). Other examples of definitional ambiguity are frequent. For example, Reynolds and colleagues (2007) described ethnocentrism, authoritarianism, social dominance orientation, and personal need for structure as personality variables (though under the current definitions, the first three would be ideological orientations and the last a motivation). In an effort to clarify this issue, Duckitt and colleagues (2001, 2002, Sibley & Duckitt, 2008) noted that “although the view that RWA, and possibly also SDO, constitute personality dimensions that determine generalized prejudice is still quite widely held, it has been increasingly criticized. The items [of these scales] ... do not refer to generalized behavioural dispositions, as the items of personality scales typically do, but to social attitudes and beliefs that express basic values of a broadly ideological nature” (Sibley & Duckitt, 2008, p. 3). This distinction between dispositional and ideological measures has been fruitfully upheld by some researchers (e.g. Van Hiel et al., 2016; Duckitt & Sibley, 2009; Perry & Sibley, 2012; Gerber et al., 2010; Hodson & Dhont, 2015) but neglected by others (e.g. Reynolds et al., 2007; Pratto, Sidanius, Stallworth, & Malle, 1994), and so developing clear terminological and methodological standards for the field to avoid such confounds is necessary for the advancement of empirical and theoretical research on ideologies.

Another challenge in the measurement of ideology is that the most widely used tool is a test of political conservatism. Specifically, it is typically assessed via a 7- or 9-point Likert scale on which participants indicate whether they feel “strongly conservative” or “strongly liberal”. Nonetheless, the standard single-item Likert scale assessment tool does not distinguish between social, economic, and cultural conservatism, and individuals’ evaluation of specific social issues, which have been shown to have different psychological correlates (Malka & Soto, 2015; Malka, Lelkes, & Soto, 2017; see also: Azevedo, Jost, Rothmund, & Sterling, 2019). Additionally, this approach assumes that the “strongly conservative” and the “strongly liberal” are equivalent in the magnitude and variance of their extremity, dogmatism, and partisanship to a political party. This is a claim that has not been directly and rigorously tested. Consequently, the typical measurement tool that seeks to tap into political ideology may not capture the full spectrum and forms of right-wing and left-wing ideological beliefs and does not adequately address ideological adherence



processes such as dogmatism, group affiliation, willingness to engage in collective action and self-sacrifice, and ideological extremism. The reliance on problematic assessment tools will inadvertently bias the conclusions of past research. Throughout the dissertation, past findings whose interpretations may have been skewed by these methodological weaknesses will be highlighted.

## **1.4 Theoretical Approaches**

### **1.4.1 *The Cognitive Rigidity Hypothesis***

Psychologists have sought to identify the psychological underpinnings of authoritarianism, ethnocentrism, and xenophobia since the beginning of the 20th century. One prominent hypothesis developed in the 1940s proposed that ideological rigidity is rooted in mental rigidity. Specifically, it was suggested that “one of the characteristics of ethnocentric thinking is a rigidity and inflexibility of the thinking process” (Rokeach, 1948, p. 259) and “general rigidity and intolerance...serve as primary sources of the specific phenomena in the prejudice area” (Hartley, 1946). This hypothesis emerges from the notion that extreme group identities and ideologies are often characterized by a tendency to categorize the world and people in an inflexible and essentialist manner (Brewer, 1999; Tajfel & Turner, 1979). Consequently, individuals with a more categorical, inflexible thinking style may tend to adhere to ideologies in a stricter or more extreme fashion. Adorno and colleagues’ (1950) pivotal book, *The Authoritarian Personality*, further developed these ideas by providing empirical support to the hypothesis that prejudice is tightly linked to rigidity and intolerance of ambiguity. Indeed, Else Frenkel-Brunswik (one of the authors of *The Authoritarian Personality*) already noted in 1948 that children who scored highly on prejudice measures exhibited greater rigidity on arithmetic and perceptual tasks than children who scored low on prejudice (Frenkel-Brunswik, 1948, 1949; Frenkel-Brunswik & Havel, 1953). The hypothesis that ideological rigidity originates from psychological rigidity thus sparked a rich line of research in political psychology, under the assumption – well-articulated by Gordon Allport in *The Nature of Prejudice* – that “the style of thinking that is characteristic of prejudice is a reflection, by and

large, of the prejudiced person's way of thinking about *anything*" (Allport, 1954, p. 400; emphasis in original; also cited in Roets & Van Hiel, 2011).

While the original inflexibility hypothesis was primarily concerned with ethnocentrism and intolerance, modern political psychology has focused on the relationship between psychological rigidity and politically right-wing attitudes (Jost et al., 2003a; Van Hiel et al., 2010, 2016), rather than with ideological or intolerant attitudes more generally. Nonetheless, ideological commitment can be evident in one's nationalistic attachment (Mummendey et al., 2001; Zmigrod, Rentfrow, & Robbins, 2018), religious doctrine (Besta, Gómez, & Vázquez, 2014; Fredman, Bastian, & Swann, 2017), political attitudes (Jost, 2017), or even deep loyalty to a sports team (Newson et al., 2018; Xiao & Van Bavel, 2012). Consequently, in the present studies, it was hypothesized that cognitive rigidity would be a characteristic of ideological thinking across multiple domains, including nationalism, religion, political extremism (on both left-wing and right-wing political parties), and general dogmatic thinking. This hypothesis thus departs from past work focusing specifically on right-wing attitudes by positing that cognitive rigidity is also implicated in extreme left-wing attitudes as well as other ideological domains, such as religion, nationalism, and dogmatism, which have not been previously subject to theorising with respect to the cognitive rigidity hypothesis.

#### **1.4.2 *Defining and Measuring Cognitive Rigidity***

In the neuropsychological literature, cognitive flexibility is defined as the ability to adapt to novel or changing environments and a capacity to switch between modes of thinking (Cools & Robbins, 2004). Specifically, it can be defined as "the ability to flexibly switch perspectives, focus of attention, or response mappings" (Diamond, 2006, p. 70). Cognitive inflexibility is therefore represented by perseveration, "the tendency of an individual *not* to change" (Schultz & Searleman, 2002, p. 166), and maladaptive continuation of unrewarded behaviours and thought patterns.

There is significant individual variation in cognitive flexibility within the general population (Braver, Cole, & Yarkoni, 2010; Miyake & Friedman, 2012), which has been linked to dopaminergic functioning (Barnett, Jones, Robbins, & Müller, 2007). Furthermore, from a clinical perspective, some populations manifest a deficit in cognitive flexibility by persisting with previously-established rules or behavioural patterns even when this is maladaptive, as evident in patients of obsessive-compulsive disorder (Chamberlain et al., 2006), addiction (Verdejo-Garcia, Pérez-García, & Bechara, 2006), and frontal lobe damage (Anderson, Damasio, Jones, & Tranel, 1991).

As reviewed by Ionescu (2012), there are several behavioural tasks that are classically used to operationalize cognitive flexibility in adults, including the Wisconsin Card Sorting Test (Grant & Berg, 1948), task switching and optional shift paradigms (Miyake & Friedman, 2012; Monsell, 2003), the Alternative Uses Task (AUT; Guilford, 1967), insight problems, and induction tasks (Shafto, Coley, & Vitkin, 2007). In these tasks, performance is measured via participants' accuracy rates, reaction times, or the number and variety of provided responses to open-ended problems. Given the extensive use and validation of behavioural tasks for assessing cognitive flexibility in neuropsychology and cognitive science, the present studies will rely on three established and independent behavioural measures of cognitive flexibility in order to investigate the relationship between inflexibility and ideology.

Specifically, the studies here will operationalize cognitive flexibility using three validated cognitive tasks that tap into implicit cognitive tendencies to categorize information and rules in a flexible versus more rigid fashion: the Wisconsin Card Sorting Test (WCST), the Remote Associates Test (RAT), and the Alternative Uses Test (AUT). Either all three tasks or a selection of these will be employed in each study (except for Chapter 6). The classic WCST (Grant & Berg, 1948) measures how easily individuals adapt to changes in newly-learned rules and reward contingencies and the extent to which individuals can switch between categories when it is disadvantageous to persist with a previously-rewarded category. High scores indicate a flexible cognitive processing style. The RAT (Mednick, 1968) measures individuals' ability to generate semantic connections between remote concepts. For instance, participants

are shown three remotely-connected words (e.g. *worm, shelf, end*) and asked to find the compound word that links them (e.g. *book*). The RAT therefore indicates the extent to which participants' semantic networks tend to categorize concepts more loosely – which would aid detection of remote conceptual connections – or rigidly, which would render such retrieval challenging (Zmigrod & Zmigrod, 2016). The AUT (Guilford, 1967) requires that participants provide as many conventional and unconventional uses to common objects, such as a brick or a hairpin, and thereby assesses four cognitive dimensions, including flexibility. Flexibility is quantified as the number of distinct conceptual categories into which a participant's set of responses can be divided. It has been used as a measure of cognitive flexibility in multiple behavioural and neuroimaging studies (e.g. Netz, Tomer, Axelrad, Argov, & Inbar, 2007; Roberts et al., 2017).

Notably, Eslinger and Grattan (1993) suggested there are at least two facets to cognitive flexibility: *reactive* flexibility, which refers to the readiness to shift behavioural responses in reaction to external cues and changing situational demands, and *spontaneous* or *generative* flexibility, which refers to the ability to generate diverse and novel ideas, typically in response to a single question. Eslinger and Grattan (1993) noted that a classic measure of *reactive* flexibility is the Wisconsin Card Sorting Test (WCST; Grant & Berg, 1948; Heaton, 1981) as it assesses the ease with which individuals can alternate between rule categories when environmental contingencies change. *Spontaneous* cognitive flexibility is measured with generative divergent thinking tasks (Eslinger & Grattan, 1993; Tomer et al., 2002), typically with the flexibility measure of the Alternative Uses Task (Guilford, 1967, 1971; Ionescu, 2012; Roberts et al., 2017). Reactive and spontaneous flexibility have been behaviourally and neurally dissociated in previous empirical work (e.g. Cools et al., 2000; Parkin & Lawrence, 1994; Tomer et al., 2002, 2007). The Remote Associates Test may be conceptualized as merging elements of reactive and spontaneous cognitive flexibility, as it tests the way in which participants flexibly search internal conceptual networks in response to convergent external cues, and their ability to reactively restructure their thinking when they identify semantic connections between some but not all of the cue words (Isen, 1990). The RAT is therefore a valuable complementary index of cognitive

flexibility to the WCST and AUT. Another distinction between these tasks is the modality: while the WCST is a visual task, in which participants are asked to evaluate and make choices amongst visual stimuli, the RAT and AUT are both verbal tasks that require participants to generate appropriate written responses. Consequently, the use of these diverse tasks will allow us to assess convergence between different facets of cognitive flexibility.

### **1.4.3**     *Current Studies*

Rigid ideological thinking was hypothesized here to be related to domain-general cognitive rigidity. This was tested in the context of nationalistic ideology and identity (Chapter 2), religiosity (Chapter 3), political partisanship (Chapter 4), and content-free dogmatic tendencies (Chapter 5). By using validated cognitive tasks that tap into implicit cognitive tendencies to categorize information and rules in a flexible versus more rigid fashion, we were able to harness modern technological advances to address an age-old question. The use of objective, behavioural measures of cognitive flexibility was particularly important given that a majority of studies rely on self-reported measures of inflexibility (as evident in the meta-analyses of Jost et al., 2003a; Van Hiel et al., 2010; Jost, 2017). Moreover, as discussed above, Van Hiel and colleagues (2016) recently found that operationalizing cognitive style using self-report measures rather than behavioural assessments can inflate effect sizes. Consequently, the current studies sought to explore the role of behaviourally-assessed cognitive flexibility in relation to a large and diverse set of ideological domains.

## 1.5 Data-Driven Approaches

The pioneering philosopher of science Karl Popper wrote in *The Logic of Scientific Discovery* that “theories are nets cast to catch what we call ‘the world’: to rationalize, to explain, and to master it. We endeavour to make the mesh ever finer and finer” (Popper, 1935, p. 37). Popper subsequently built an entire “theory of theories” (Popper, 1935, p. 37), focusing on how scientists can and should refine their understanding of phenomena by falsifying hypotheses with carefully designed experimental tests. However, on the question of how theories emerge in the first place, Popper claimed that this is an issue for the psychologist: “The question of how it happens that a new idea occurs to a man – whether it is a musical theme, a dramatic conflict, or a scientific theory – may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge” (Popper, 1935, p. 7). Nonetheless, following Popper, both philosophers and psychologists have been concerned with the ways in which hypotheses and theories are generated by scientists, and how researchers’ historical, ideological, and paradigmatic context can fundamentally shape science (e.g. Kuhn, 1962).

In light of the ongoing reproducibility crisis in psychology (John, Lowenstein, & Prelec, 2012; Makel, Plucker, & Hegarty, 2012; Pashler & Wagenmakers, 2012; Van Bavel, Mende-Siedlecki, Brady, & Reinero, 2016), psychologists have indeed been re-evaluating the origins of their theories and practices. One facet of the field’s self-examination has involved assessing the extent to which psychological research is influenced by researchers’ characteristics, ideologies, and agendas (Duarte et al., 2015; Haidt & Jussim, 2016; Inbar & Lammers, 2012; Jussim, Crawford, Anglin, Stevens, & Duarte, 2016; Reinero, Wills, Brady, Mende-Siedlecki, Crawford, & Van Bavel, 2019; Skitka, 2012; Von Hippel & Buss, 2017). In order to ensure that theories in social and political psychology are not unduly influenced by researchers’ preconceptions and political agendas, there is now increasing interest in complementing theory-driven approaches with *data-driven* approaches wherever appropriate and feasible. Data-driven approaches are those that make use of large, unique datasets and utilize novel

analysis techniques designed to deal with large datasets in order to extract underlying patterns, with no a priori hypothesis<sup>8</sup>.

Chapter 6 delineates the application of this data-driven approach to the task of investigating the psychological correlates of ideological thinking. It involved producing a large dataset in collaboration with Russell Poldrack and colleagues at Stanford University, which administered an unprecedented number of cognitive tasks and personality questionnaires to over 500 participants in 2016. The aim of the original project was to elucidate the structure of self-regulation, and so a large battery of tasks and questionnaires that span most of the classic psychological phenomena broadly associated with self-control was created. In 2018, as part of the present doctoral research, these participants were contacted again and invited to complete several ideological attitudes questionnaires. Harnessing this unique dataset allowed us to comprehensively examine the cognitive and personality substrates of ideological thinking across a multitude of ideological domains, and the temporal and conceptual separation of the collection of the psychological and ideological data enabled us to overcome typical methodological challenges in this field. It was also an opportunity to implement sophisticated data analytic techniques that have been designed to probe large datasets in the natural sciences, but have rarely been used in the context of the psychological sciences.

## 1.6 Overview and Scope

History has witnessed countless acts of violence committed in the name of ideologies, and so scholars across the social and natural sciences have long sought to resolve why some people become ideologically dogmatic and extreme while others in their community do not. Chapters 2-5 will focus on testing the cognitive rigidity hypothesis in the realms of nationalism (Chapter 2; reflects Zmigrod, Rentfrow, & Robbins, 2018 in *PNAS*), religiosity (Chapter 3; reflects Zmigrod et al., 2018 in

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<sup>8</sup> Accordingly, a philosophy of science with regards to data-driven approaches is now flourishing and aiming to negotiate and integrate this novel form of data collection and analysis into Popperian, Kuhnian, and Lakatosian frameworks (e.g. Krohs, 2012; Kell & Oliver, 2004; Leonelli, 2015; Lowrie, 2017; Mazzocchi, 2015)

*Psychological Research*), political partisanship (Chapter 4; reflects Zmigrod, Rentfrow, & Robbins, 2019b in *Journal of Experimental Psychology: General*), and intellectual humility (Chapter 5; reflects Zmigrod et al., 2019 in *Personality & Individual Differences*). Chapter 6 then expands beyond flexibility and instead relies on a data-driven approach in a unique sample to address two primary questions: (1) Do psychological traits predict ideological orientations beyond classic demographic variables? And (2) what cognitive and personality characteristics are most predictive of ideological thinking in the domains of politics, nationalism, religiosity, and dogmatism? Chapter 7 synthesizes this set of studies into overarching conclusions, identifies their limitations, and offers directions for further research in order to refine, expand, and deepen the study of ideological cognition.



# 2

## **Chapter 2**

### Rigidity of Thought and Inflexible Borders: A Cognitive Analysis of British Nationalism



## 2 Rigidity of Thought and Inflexible Borders: A Cognitive Analysis of British Nationalism

### 2.1 Introduction

Throughout modern history, nationalism has played a prominent role in citizens' voting behaviour and political engagement. Indeed, recent slogans such as "Make America Great Again" and "Take Back Control" have been used by political campaigns to attract voters. The potency of nationalistic identity was particularly evident in the United Kingdom's June 2016 EU Referendum, in which voting patterns crossed political party lines and family traditions, surprising pollsters and political analysts. There has been a long and rich tradition of research on nationalism, patriotism, and voting behaviour in social psychology and political science (Adorno et al., 1950; Altemeyer, 1996; Huddy & Khatib, 2007; Kam & Ramos, 2008; Kosterman & Feshbach, 1989; Schatz & Staub, 1997; Schatz et al., 1999; Sidanius & Lau, 1989; Staub, 1989; Transue, 2007), as well as a large body of empirical work in political psychology (for reviews see: Jost, 2017; Jost, van der Linden, Panagopoulos, & Hardin, 2018) showing psychological differences between individuals of varying political orientations (Jost et al., 2003a; Graham, Haidt, & Nosek, 2009; Hibbing, Smith, & Alford, 2014).

Despite the significant contributions of this work, there is still a need for further empirical work on the cognitive processes that underlie individuals' adoption of nationalistic attitudes. Although nationalism is typically correlated with right-wing (as opposed to left-wing) orientation, nationalistic attachment is, in principle, distinct from political ideology. While many diverse issues are often clustered into party politics or conservative versus liberal orientations, including views on economic policies, religion, inequality, environmental protection, and civil rights, nationalism tends to focus primarily on perceptions of national superiority and idealization of the nation and its dominance or history (Kosterman & Feshbach, 1989; Schatz & Staub, 1997; Staub, 1989). Thus, it is important to explore how the findings from political

psychology – which have identified differences between conservatives and liberals in their personalities (Caprara & Zimbardo, 2004; Carney, Jost, Gosling, & Potter, 2008), need for order and structure (Jost et al., 2003a; Caparos et al., 2015; Chirumbolo, 2002), cognitive control and inhibition (Amodio et al., 2007), and physiological reactivity (Hibbing et al., 2014; Oxley et al., 2008; Tritt et al., 2016) – translate into the study of nationalistic ideology.

Since the publication of the *Authoritarian Personality* in the 1950s (Adorno et al., 1950), psychologists have hypothesized that right-wing and xenophobic attitudes are related to a cognitive style characterized by psychological rigidity (Jost, 2017). However, when cognitive processes have been studied in relation to political ideologies, there has often been disagreement over the definition and measurement of ‘cognitive style’ (Van Hiel et al., 2016; Onraet et al., 2015). Many studies rely on self-report questionnaires (e.g. Sargent, 2004; Conway et al., 2015) rather than objective tests measuring cognitive function. Indeed, a recent study revealed significant differences in the magnitude of the relationship between cognitive style and political ideology according to whether the measure of ‘cognitive style’ was based on behaviour or self-report (with self-report scales yielding stronger relationships with right-wing attitudes; Van Hiel et al., 2016). The present study therefore examines the relationship between the strength of individuals’ nationalistic identities, their nationalistic attitudes, and their cognitive performance, using validated tests from cognitive neuropsychology, as well as self-reported psychological traits, to address the question: *do individual differences in cognitive characteristics predict nationalistic attitudes and identity?*

The EU Referendum in the UK probed citizens’ commitment to separating from the EU, and their support for the recreation of economic, legal, and physical boundaries in order to reduce multiculturalism and reinstate “control” that had been “taken away” from the “British people” (Goodwin et al., 2015, 2017). The outcome of the referendum depended on the breadth versus narrowness of citizens’ definitions of “British people” and “British society”. And in the months following the result, numerous arguments were made about the characteristics and motives of *Leave* and

*Remain* supporters, with some speculating that *Leave* supporters were motivated by a sense of British nationalism and ideology. To date, there is very little direct empirical evidence available about the impact that nationalism or nationalistic identity might have had in the EU Referendum. However, we can draw from psychological theory and research to develop hypotheses about which psychological factors may have influenced voters' decisions.

Social-psychological theories have long contended that categorization of individuals into groups is a key process in social identity formation (Tajfel, 1982; Turner et al., 1987). Indeed, at the heart of nationalistic ideologies are strict categories and rules for what is or is not part of the nation or national culture. We hypothesized that nationalistic thinking may be an instance of a general tendency to rigidly categorize information and to process information in an inflexible manner, such that cognitive inflexibility would be predictive of support for Brexit in the context of the UK's 2016 EU Referendum. While upholding tight, impermeable mental boundaries between concepts can be beneficial for mechanistic thinking, it can also lead to challenges in adapting to change or uncertainty.

To objectively assess implicit cognitive flexibility, two cognitive tasks were used: (1) the classic Wisconsin Card Sorting Test (WCST; Grant & Berg, 1948; Heaton, 1981), which measures individuals' adaptability to changes in newly-learned rules and reward contingencies, and therefore how easily they can switch between categories when it is maladaptive to persist with a previously-rewarded category. This measures *reactive* flexibility and can indicate a persisting versus adapting cognitive processing style, and has been used extensively to study clinical populations such as patients with frontal-lobe damage (Anderson et al., 1991), OCD (Lucey et al., 1997), and schizophrenia (Sullivan et al., 1993). Furthermore, (2) the Remote Associates Test (RAT; Mednick, 1968), which measures individuals' capacity to flexibly retrieve semantic associations between remote conceptual representations, was also administered to provide a complementary index of a 'flexibility' construct. Participants are presented with three words (e.g. *cracker, fly, fighter*) and must generate the compound word that links these three words (e.g. *fire*). It is therefore a verbal

measure of *generative* flexibility. Performance indicates participants' associative flexibility and the extent to which their semantic networks tend to categorize concepts more loosely (which would facilitate detection of connections between remote concepts) or rigidly (which would make such retrieval difficult). These tasks and measures lack any ideological or emotional content, employing generally emotionally-neutral stimuli.

In order to compare the psychology of nationalistic and political ideologies, and to address the methodological debate regarding self-report and behavioural measures of cognition (Van Hiel et al., 2016), self-reported psychological flexibility was also assessed. This was measured through participants' intolerance for uncertainty and dependence on routines and traditions in their daily lives, which act as proxies for subjective behavioural flexibility in contexts of ambiguity and volatility. We hypothesized that individuals who report subjective inflexibility would tend to prefer the traditionalism and certainty offered by strong nationalistic ideologies.

Given the current political climate in Europe and the USA, there is an urgent need to investigate the cognitive roots of nationalistic attitudes. Cognitive and subjective flexibility were examined in relation to four ideological orientations: nationalism, right-wing conservatism, system justification, and authoritarianism. These psychological and ideological dimensions were studied in relation to individuals' voting behaviour in the EU referendum, as well as their Brexit-related attitudes towards the EU and immigration, and measures of nationalistic identity. Hence, the aim of this study was to explore the cognitive and psychological factors that underlie individuals' adoption of nationalistic ideologies, beyond demographic variables and family traditions, and to investigate the pathways between inflexible cognition, ideological thinking, and nationalistic attitudes.

## 2.2 Materials and Methods

### 2.2.1 *Participants*

A total of 391 participants was recruited through Prolific Academic, an established platform for online research (Peer et al., 2017, for more information about Prolific Academic see: <https://www.prolific.ac/>), and were financially compensated for their participation. Participants provided their informed consent prior to participation by indicating their agreement to share information about their ideological views, demographic variables, and to perform several psychological tasks. All survey items were optional or allowed the participant to indicate that they “prefer not to respond” to the particular question. Participants were able to leave feedback at the end of the experiment. The experimental and consent procedures were approved by the University of Cambridge’s Department of Psychology Ethics Committee. After removing participants who were not UK residents or had dual citizenship ( $n=59$ ), the final overall sample was 332 (47.1% female, age:  $M=37.96$ ,  $SD=13.69$ ). Within the UK, participants identified with England (84.3% of sample), Scotland (9.0%), Wales (5.4%), and Northern Ireland (1.2%). With respect to voting behaviour in the 2016 EU Referendum, 62.5% of the sample voted Remain and 37.5% voted to Leave the EU.

### 2.2.2 *Measures and Procedure*

Participants were redirected from Prolific Academic to an online survey hosted by Qualtrics Survey Software for completion of all the self-reported items and the RAT, and later redirected again to Inquisit 5 by Millisecond Software in order to temporarily download software that allows for accurate measure of performance and reaction times in the WCST. Participants were asked about their UK residency status, voting behaviour in the June 2016 EU Referendum, political party affiliations, and other demographic variables such as age, gender, and educational attainment.

Educational attainment was categorized along five groups: (1) participants with no formal educational qualifications (1% of sample), (2) participants who completed GCSEs or equivalent qualifications (9.5% of sample), (3) participants who completed two or more A-Levels or an apprenticeship (19.0% of sample), (4)

participants who completed a bachelor's degree or equivalent (63.3% of sample), and (5) participants who completed a doctoral degree or equivalent (7.2% of sample). It is noteworthy that the present sample has a higher proportion of Remain voters than Leave voters, and participants in general had high levels of educational attainment, so it would be valuable to replicate these findings in a more demographically-representative sample.

## **Cognitive Flexibility**

### *Wisconsin Card Sorting Test (WCST)*

The WCST (Grant & Berg, 1948) was administered with Inquisit 5 by Millisecond Software in standard fashion (Heaton, 1981). Participants are presented with four key cards and a deck of response cards that vary on three dimensions (colour, shape, and number of geometric figures) and are asked to match a fifth card from the sequentially-presented response cards to one of the four key cards. There are various potential rules that can underpin the classification, for instance matching the cards by shape, number, or colour. Participants are required to identify and apply the correct card classification rule in accordance with the feedback they receive after each trial. Participants are informed at the start of the task that the card classification rule can change without warning. Correspondingly, after participants correctly respond to ten consecutive trials the classification rule changes, requiring a flexible set shift. The task terminates after participants complete six categories (twice for each of the three classification rules) or after 128 trials. Participants' performance is indexed through the accuracy rate and the number of categories they completed during the task.

### *Compound Remote Associates Test (RAT)*

The compound RAT (Mednick, 1968) consisted of 20 compound remote associate problems, in which participants are presented with three cue words (e.g. *fly, cracker, fighter*), and are asked to generate the compound word solution that links these three words (e.g. *fire*). Participants were given 20 seconds to provide an answer to each problem. Problems of varying difficulty levels were selected from a bank of validated remote associate items (Bowden & Jung-Beeman, 2003). The RAT has been used as a



measure of cognitive flexibility in previous literature (Isen, 1990; Alexander et al., 2007; Ishizuka, Hillier, & Beversdorf, 2007; Nijstad et al., 2010), and measures the degree to which participants are able to restructure their thinking after identifying a semantic association between some, but not all, of the cue words. For instance, when presented with *tooth*, *potato*, and *heart*, participants often tend to first generate *ache* as a compound word solution (*tooth-ache*, *heart-ache*); however, successful participants overcome this initial association and are able to flexibly re-evaluate the cues so as to arrive at the correct solution that also connects to the third cue word, i.e. *sweet* (*sweet-tooth*, *sweet-potato*, *sweet-heart*). RAT performance can therefore generate insight about the way in which established associative networks and conceptual categories are internally arranged, accessed, and flexibly explored.

## **Subjective Flexibility**

### *Intolerance for Uncertainty*

Intolerance for Uncertainty was assessed with Carleton, Norton, and Asmundson's (2007) 12-item scale (Cronbach's alpha = .90), which included items such as "Unforeseen events upset me greatly", "When I am uncertain I can't function very well", "The smallest doubt can stop me from acting", and "I must get away from all uncertain situations". Items were rated on a Likert scale from 1 (*Not at all characteristic of me*) to 5 (*Entirely characteristic of me*).

### *Dependence on Routines*

Participants' dependence on routines in their daily lives was measured with a 7-item Likert scale ranging from 1 (*Not at all characteristic of me*) to 5 (*Entirely characteristic of me*) (Cronbach's alpha = .78). Items included: (a) "I hate it when my routines are disrupted", (b) "I tend to change my plans last minute" (reverse-coded), (c) "I avoid situations where unexpected things might happen", (d) "Traditions are important to me", (e) "Rituals are important even if they are not enjoyable", (f) "I like to have a regular, unchanging schedule", (g) "Vacations often cause me stress", and (h) "I always go on vacation to the same destination". All items were evaluated on a

7-item Likert scale ranging from 1 (*Not at all characteristic of me*) to 5 (*Entirely characteristic of me*)

## **Ideological Orientation Variables**

### *Authoritarianism*

Authoritarian beliefs were measured with a four-item set of child-rearing questions developed by Hetherington & Weiler (2009), which asks “Which one do you think is more important for a child to have?” and then requires participants to choose one in the following pairs: “independent or respectful”, “curious or well-mannered”, “obedient or self-reliant”, and “considerate or well-behaved”. Each item is coded 0 for the non-authoritarian answer (independent, curious, self-reliant, and well-behaved) and 1 for the authoritarian answer, and a summed total is used as a measure of authoritarian beliefs.

### *Nationalism*

Nationalism was measured using items adapted to the UK from an established nationalism scale (Sidanius, Feshbach, Levin, & Pratto, 1997; Federico, Golec, & Dial, 2005; Ho et al., 2012), consisting of 6 items, each rated by participants on a Likert scale ranging between 1 (*Strong disagree*) to 7 (*Strongly agree*) (Cronbach’s alpha = .79). Items included: (a) “To maintain our country’s economic superiority, aggressive economic policies are sometimes necessary”, (b) “Generally, the more influence the UK has on other nations, the better off they are”, (c) “We should do anything necessary to increase the power of country, even if it means war”, (d) “The UK should not dominate other countries” (reverse-coded), (e) “There are many other cultures in the world that are superior to ours” (reverse-coded) and (f) “For the most part, the UK is no more superior than any other industrialized country in the world” (reverse-coded). The items’ presentation order was randomized for each participant.

## *Political Conservatism*

Political ideology was assessed by asking participants to indicate their political party affiliation in the UK, and participants responded to the question “Which of the following political parties best represents your views?”. In order to quantify these party affiliations along a left-right political conservatism spectrum, we consulted a research report by YouGov, a specialist in polling demographically-representative samples, published on September 29<sup>th</sup> 2017. Each participant’s level of conservatism was therefore matched to the estimation of their political party’s right-wing conservatism. Political ideology was assessed by asking participants to indicate their political party affiliation in the UK, and participants responded to the question “Which of the following political parties best represents your views?” and were able to choose between: “Conservative Party” (N=63), “Labour Party” (N=70), “Liberal Democrats” (N=62), “Scottish National Party” (N=12), “UK Independence Party” (N=21), “Green Party” (N=41), “Plaid Cymru” (N=4), “Democratic Unionist Party” (N=2) and “Don’t know/Other/Prefer not to say” (N=57). In order to quantify these party affiliations along a left-right political conservatism spectrum, we consulted a research report by YouGov, a specialist in polling demographically-representative samples, published on September 29<sup>th</sup> 2017, which reported data collected from 46,643 participants across the UK in June 2017. In this report YouGov provides data regarding participants’ self-identification on the left-right political spectrum in relation to their past voting behaviour in the 2015 Election. For each political party, we calculated a ratio of the percentage of participants who self-identified as “very or fairly right wing” (for the Conservative Party and UKIP) or “very or fairly left wing” (for all other political parties) divided by the percentage of participants who identified as “centre or slightly left/right of centre”. This provided a proxy measure of the level of right wing conservatism of each political party. These calculations provided the following conservatism scores for each political party: UKIP (+2.27), Conservative Party (+1.55), Liberal Democrats (-0.64), Plaid Cymru (-1.00), Scottish National Party (-1.75), Labour Party (-2.5), and Green Party (-5.5). There was no data for the Democratic Unionist Party (however, since only 2 participants in our sample affiliated with the DUP, this did not hinder the analysis). Each participant’s level of

conservatism was therefore matched to the estimation of their political party's right-wing conservatism.

### *System Justification*

The system justification scale comprised of 8 items from Kay & Jost's (2003) measure, adapted to British society: (a) "In general, British society is just and fair", (b) "In general, the British political system operates as it should", (c) "British society needs to be radically restructured" (reverse-coded), (d) "The UK is the best country in the world to live in", (e) "In the UK, most policies serve the greater good", (f) "In the UK, everyone has a fair shot at wealth and happiness", (g) "British society is getting worse every year" (reverse-coded), (h) "British society is set up so that people usually get what they deserve". All items were randomly ordered. Cronbach's alpha was .88.

## **Nationalistic Identity**

### *Attitudes towards Brexit-related issues*

Based on the format of Everett's (2013) Social and Economic Conservatism Scale, participants were asked about their feelings of positivity versus negativity towards a number of issues linked to Brexit on a Likert scale between 0 and 100. The issues included: (a) Brexit, (b) European Union, (c) Immigration, (d) Access to the EU Single Market, and (e) Free Movement of Labour. In addition, participants were asked to rate their agreement with the following two statements: "The UK government has a right to remain in the EU if the risks are too high", and "If you are a citizen of the world, you are a citizen of nowhere" (the latter of which was borrowed from Prime Minister Theresa May's speech to the Conservative Party in October 2016).

### *Identity Fusion*

To measure participants feeling of "oneness" with the UK and the EU, participants were presented with validated measure of identity fusion, the Dynamic Identity Fusion Index (DIFI; Jimenez et al., 2016), consisting of a continuous pictorial representation that allows participants to move a small circle representing "the self" by clicking and dragging it toward or away from a large circle representing "the

group". The distance between the centres of the two circles has been shown to indicate the extent to which individuals feel their personal identity is fused with a collective identity (Jimenez et al., 2016). It has temporal stability, as well as convergent and discriminant validity, and can predict the endorsement of pro-group behaviours (Jimenez et al., 2016). In this study, participants were presented with the DIFI twice; once where the group was the "United Kingdom" and another when the group was "Europe". A difference score was then computed on the distance scores of UK and Europe fusion in order to identify the extent to which participants' group fusion was specifically nationalistic.

## **Structural Equation Models**

All models were estimated in the Lavaan software package (Version 5.23; Rosseel, 2012) in R (R Development Core Team, 2016) using full information maximum likelihood (ML) with robust standard errors in order to account for multivariate nonnormality and missingness. Overall model fit was assessed with the chi-square test, RMSEA and its confidence interval (acceptable: 0.05-0.08), the Comparative Fit Index (CFI; acceptable: 0.95-0.97), and SRMR (acceptable: 0.05-0.10), and the Yuan-Bentler scaling factor was reported for each model (Schermelleh-Engel et al., 2003; Cangur & Ercan, 2015). Models were compared using a chi-square test when the models were nested, and using the AIC in all other cases (in accordance with guidelines by Burnham & Anderson (2004)).

## 2.3 Results

The sample consisted of 332 UK citizens recruited through Prolific Academic (47.1% female, age:  $M=37.96$ ,  $SD=13.69$ ) who voted in the EU Referendum in June 2016. Correlations among Brexit-related attitudes (support for Brexit and opposition to immigration, the EU, and free movement of labour) were mostly moderate to large, as expected, with  $r$ s ranging from  $|.28|$  and  $|.80|$ , all  $p$ s $<.001$  (Table 2.1), confirming that these attitudes are related, but that they also tap different views. Furthermore, support for Brexit was quite strongly correlated with all four ideological variables (authoritarianism, nationalism, conservatism, and system justification); here the  $r$  ranged from  $.33$  to  $.65$ , all  $p$ s $<.001$ , suggesting that pro-Brexit attitudes were related to heightened authoritarianism, nationalism, conservatism, and system justification (Table 2.1). Notably, the intercorrelations amongst the ideological orientation measures were moderate to large in magnitude ( $r$  ranged from  $|.19|$  to  $|.53|$ , all  $p$ s $<.01$ ), indicating that whilst these variables are related, there is more than one separable ideological construct involved.

The correlation between the two objective cognitive flexibility measures (WCST and RAT accuracy;  $r=.19$ ,  $p=.007$ ) was modest, and between the two subjective flexibility measures ( $r=.62$ ,  $p<.001$ ) was high. The cognitive and subjective flexibility measures were modestly or not significantly related. Intolerance for uncertainty was negatively related to the WCST accuracy rate ( $r=-.15$ ,  $p=.029$ ), but not to RAT accuracy rate ( $r=.02$ ,  $p>.250$ ), and there was no correlation between dependence on routines and the cognitive tests. Taken together, these results suggest that the cognitive and subjective flexibility measures are independent facets of flexible cognition.

In terms of the demographic variables, there were no differences between men and women in any of the psychological flexibility variables,  $p$ s $>.05$ . There was also no correlation between age and performance in the WCST or RAT, or in terms of self-reported intolerance for uncertainty and dependence on routines. There were significant correlations between educational attainment and RAT performance ( $r=.14$ ,  $p=.013$ ), intolerance for uncertainty ( $r=-.12$ ,  $p=.036$ ), and dependence on routines ( $r=-.13$ ,  $p=.021$ ), but not with WCST performance ( $r=-.13$ ,  $p=.056$ ). *Remain* and *Leave* voters

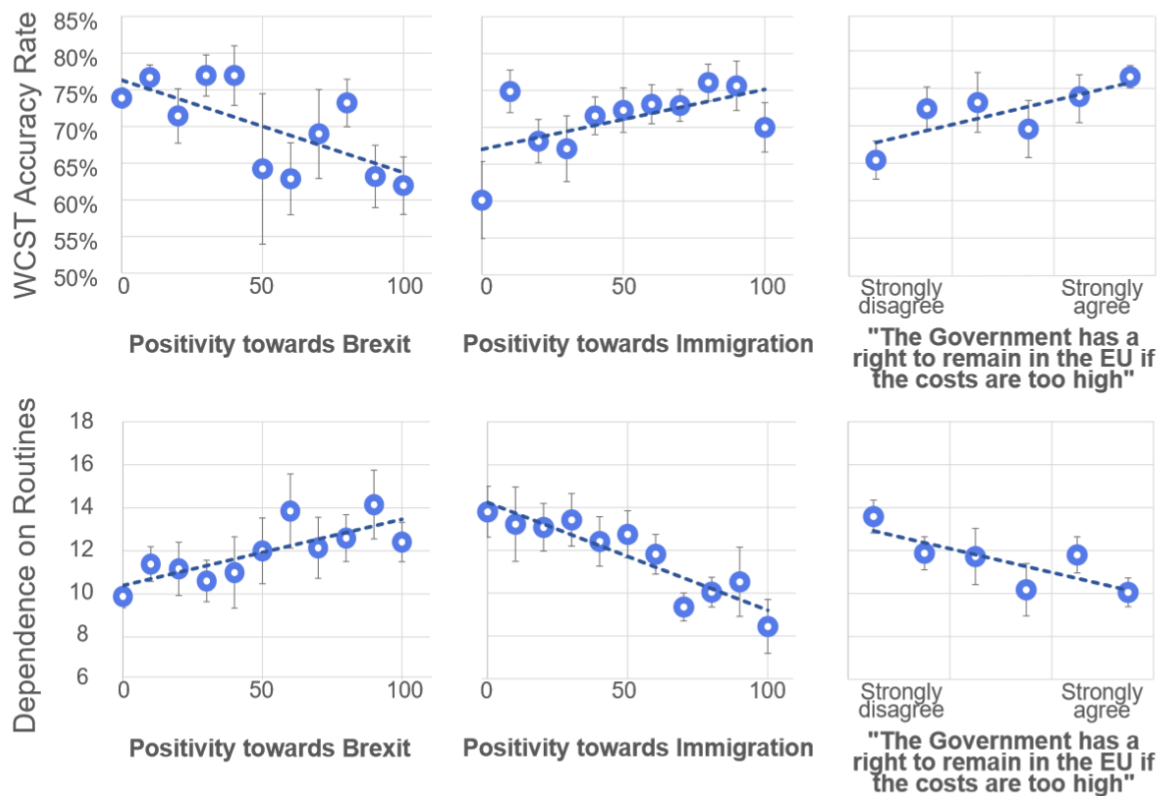
did not differ in terms of gender, but participants who voted *Remain* were younger than *Leave* voters (Remain:  $M=36.52$ ,  $SD=13.131$ ; Leave:  $M=40.37$ ,  $SD=13.943$ ;  $F(1,284)=5.560$ ,  $p=.019$ ) and had higher educational attainment (Remain:  $M=2.85$ ,  $SD=.647$ ; Leave:  $M=2.41$ ,  $SD=.887$ ;  $F(1,295)=24.041$ ,  $p<.001$ ). Given these associations, educational attainment and age were included as covariates in all subsequent analyses, unless otherwise specified.

To evaluate the strength of the relationship between Brexit voting behaviour and Brexit-related attitudes, we tested for differences in the attitude measures between Remain and Leave voters. Univariate ANCOVA, with age and educational attainment as covariates, found that, compared to Remain voters, Leave voters felt significantly more positive about Brexit ( $F(1,277)=838.211$ ,  $p<.001$ ,  $\eta_p^2=.752$ ; Remain voters:  $M=9.83$ ,  $SD=14.448$ ; Leave voters:  $M=78.35$ ,  $SD=22.994$ ) and significantly more negative about immigration ( $F(1,266)=207.857$ ,  $p<.001$ ,  $\eta_p^2=.439$ ; Remain voters:  $M=67.88$ ,  $SD=19.717$ ; Leave voters:  $M=26.19$ ,  $SD=23.262$ ), the European Union ( $F(1,275)=493.084$ ,  $p<.001$ ,  $\eta_p^2=.642$ ; Remain voters:  $M=75.76$ ,  $SD=18.991$ ; Leave voters:  $M=20.83$ ,  $SD=18.615$ ), and free movement of labour ( $F(1,268)=221.289$ ,  $p<.001$ ,  $\eta_p^2=.452$ ; Remain voters:  $M=75.88$ ,  $SD=20.452$ ; Leave voters:  $M=33.08$ ,  $SD=24.084$ ). These results and the magnitude of the effect sizes indexed by the  $\eta_p^2$  reveal a strong relationship between how participants voted and their attitudes towards Brexit-related issues. In particular, attitudes to Brexit are sufficiently closely related to be acceptable as a surrogate for voting behaviour.

### ***2.3.1 Correlations Between Brexit Attitudes and Psychological Flexibility***

The links between psychological flexibility and support for Brexit, are reflected in the cross-correlations between these two classes of measure. The results revealed significant negative correlations between cognitive flexibility on the WCST and RAT and positive feelings towards Brexit (Table 2.1; Figure 2.1) and negative feelings towards immigration, the EU, and free movement of labour (Table 2.1). This pattern of associations converged with those observed for the subjective flexibility findings, which showed significant positive correlations between subjective inflexibility

(reported reliance on daily routines and uncertainty intolerance) and pro-Brexit, anti-immigration, anti-EU, and anti-free movement of labour attitudes (Table 2.1, Figure 2.1). In accordance with Gignac & Szodorai's (2016) categorizations, the effect sizes of these correlations can be considered moderate to large.



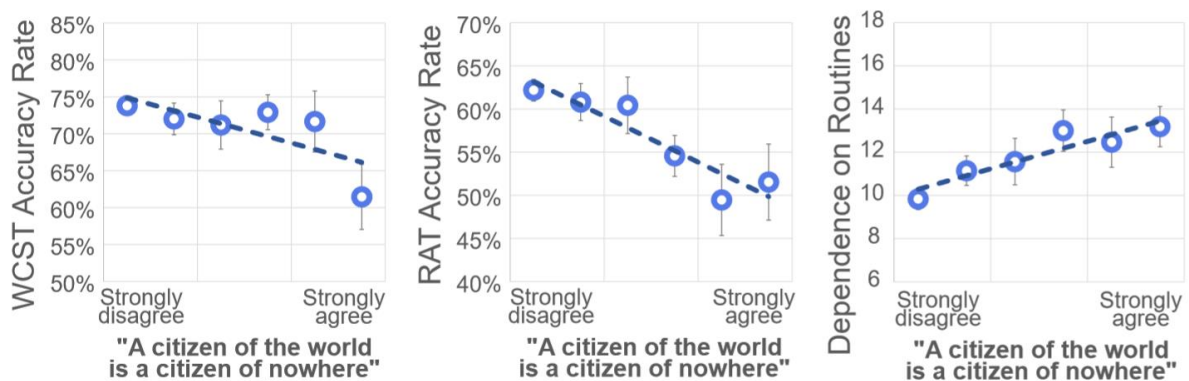
**Figure 2.1.** WCST accuracy rate and dependence on routines according to Brexit-related attitudes. Error bars reflect  $1\pm$  standard error, dashed lines reflect significant linear correlations.



**Table 2.1.** Correlations between all measures of psychological flexibility, ideological orientation, and nationalistic identity and attitudes.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 WCST % Accuracy	--	.185**	-0.099	-.148*	-.192*	-.161*	-.172*	-0.111	-.150*	-.265***	.211**	.259***	.210**	.223***	.259***	-.165*
2 RAT % Accuracy		--	0.016	0.043	-0.024	-0.068	-.165**	-.161*	-0.095	-.119*	0.065	.113*	.167**	0.033	.143*	-.217***
3 Dependence on Routines			--	.620***	.414***	.184**	.238***	0.098	.284***	.210**	-.276***	-.208**	-.264***	-.173**	-.220***	.220***
4 Uncertainty Intolerance				--	.310***	0.043	.140*	-0.011	.137*	.132*	-.232***	-.136*	-.142*	-.141*	-.162*	.161**
5 Authoritarianism					--	.257***	.445***	.191**	.418***	.454***	-.492***	-.478***	-.456***	-.454***	-.323***	.349***
6 Nationalism						--	.508***	.526***	.557***	.550***	-.423***	-.536***	-.501***	-.391***	-.332***	.428***
7 Conservatism							--	.369***	.422***	.497***	-.492***	-.460***	-.454***	-.328***	-.378**	.325***
8 System Justification								--	.376***	.333***	-.158*	-.288***	-.305***	-.176**	-0.141	.253***
9 Nationalistic Identity Fusion									--	.648***	-.555***	-.643***	-.586***	-.476***	-.434***	.431***
10 Pro-Brexit Attitude										--	-.649***	-.840***	-.706***	-.615***	-.700***	.523***
11 Anti-Immigration Attitude											--	.697***	.684***	.586***	.541**	-.409***
12 Anti-European Union Attitude												--	.734***	.707***	.642***	-.514***
13 Pro-Free Movement of Labour													--	.699***	.542***	-.461***
14 Pro-Access to EU Single Market														--	.454***	-.401***
15 Pro-Government Right to Remain															--	-.279***
16 "Citizen of World is Citizen of Nowhere" Agreement																--

Interestingly, across all of the psychological measures, subjective and objective cognitive flexibility were positively correlated with agreement that the UK government ought to be flexible with its implementation of Brexit in light of potential costs (Table 2.1; Figure 2.1), indicating that psychological flexibility in non-ideological domains may be a trait underpinning flexibility in policy evaluation. Furthermore, subjective and objective cognitive flexibility were significantly negatively correlated with agreement with the idea that “a citizen of the world is a citizen of nowhere”, a quote by UK Prime Minister Theresa May (Table 2.1, Figure 2.2). This quote may be interpreted as reflecting a highly specific and narrow definition of citizenship, as well as some negativity towards globalization; the negative correlation might therefore indicate that psychological flexibility could be linked to how broadly versus narrowly identity boundaries are drawn.



**Figure 2.2.** Cognitive flexibility (WCST and RAT performance) and dependence on routines in relation to beliefs about citizenship. Error bars reflect  $1\pm$  standard error, dashed lines reflect significant linear correlations.

To complement these results, we also examined the correlations between these psychological flexibility measures and the ideological orientation variables. Overall, individuals with high scores on these ideological factors exhibited reduced subjective and objective cognitive flexibility. As evident in Table 2.1, objective cognitive flexibility measured by the WCST was negatively correlated with authoritarianism, nationalism, conservatism, and nationalistic identity fusion. Notably, RAT performance was not correlated with authoritarianism, nationalism, or nationalistic

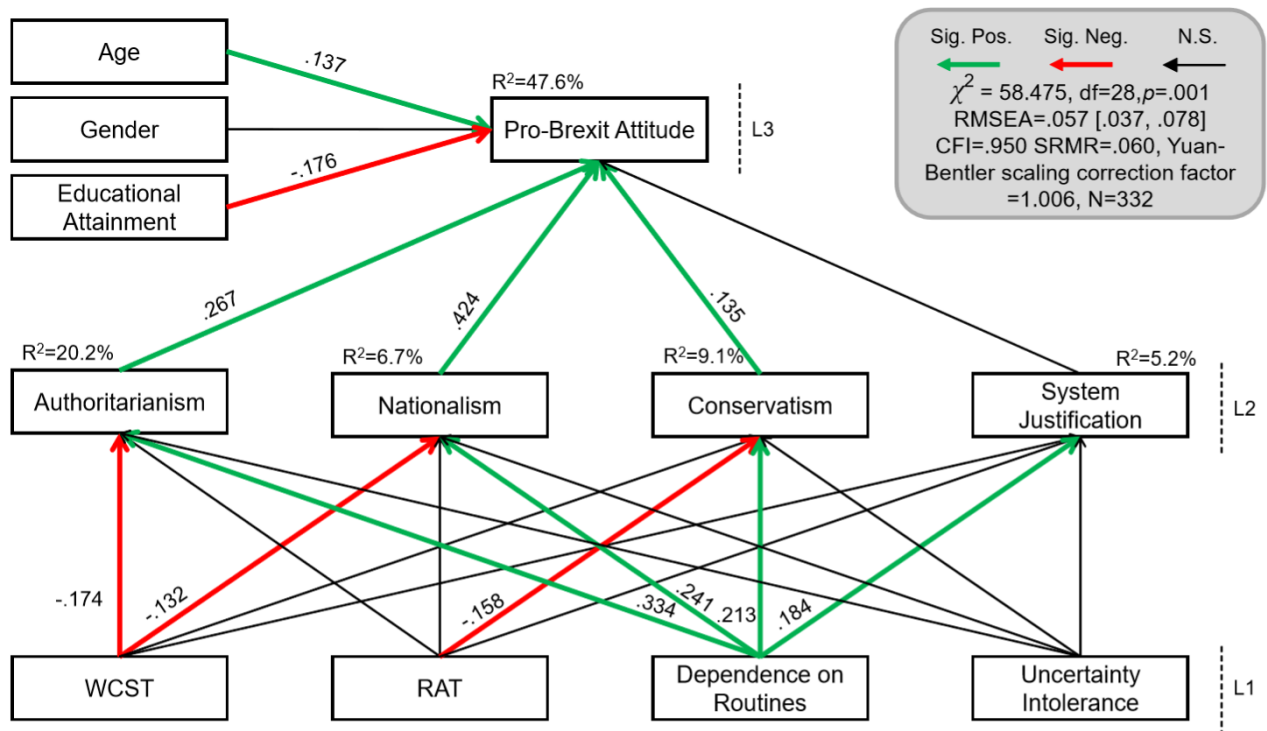
identity fusion, but was negatively correlated with conservatism and system justification. This suggests that different ideological orientations may relate to different facets of cognitive flexibility. Consistent with the pattern of results observed for the objective cognitive flexibility measures, individuals with higher self-reported flexibility in the context of uncertainty and ambiguity in their daily lives reported lower authoritarianism and conservatism. Furthermore, individuals with higher subjective flexibility were less strongly fused to the UK relative to Europe (Table 2.1). Both measures of subjective flexibility were uncorrelated with system justification, and dependence on routines was positively correlated with nationalism while uncertainty intolerance was not.

### **2.3.2 Structural Equation Models**

To develop a more comprehensive understanding of how psychological flexibility contributes to an ideological orientation that promoted support for the UK's exit from the EU, we specified a type of structural equation model called *path models* to investigate whether the ideological variables (authoritarianism, nationalism, conservatism, and system justification) mediate the relationships between the psychological flexibility variables and support for Brexit. To test this prediction, we fit a three-level model whereby Level 1 consisted of the four psychological flexibility measures (two objective cognitive flexibility measures – WCST and RAT – and two subjective flexibility measures – Intolerance for Uncertainty and Dependence on Routines). Level 2 consisted of the four ideological orientation measures – authoritarianism, nationalism, conservatism, and system justification. In our specification, psychological variables in Level 1 directly affected the ideological variables in Level 2, which in turn affected the pro-Brexit attitudes in Level 3 (see Figure 2.3). In all models we allow for residual covariances within, but not between levels. Age, gender, and educational attainment were also included as covariates of interest of Brexit attitudes, and we allowed for residual covariance between the demographic variables.

First, we tested a model in which Brexit attitudes were directly determined by both psychological and ideological variables. This model showed adequate fit to the

data ( $\chi^2=53.146$ ,  $df=24$ ,  $p=.001$ ,  $N=332$ ,  $RMSEA=.060$  [.038, .082],  $SRMR=.059$ ,  $CFI=.948$ , Yuan-Bentler scaling correction factor=.996). Next, we compared this model, in which direct effects of the psychological flexibility to Brexit attitude pathways were estimated freely, to a more parsimonious model in which psychological variables affected ideological variables, which in turn affected Brexit attitudes. This model captures the assumption that all the influence that psychological flexibility has on Brexit attitudes is mediated via the ideological variables (Figure 2.3). This model had good fit to the data ( $\chi^2=58.475$ ,  $df=28$ ,  $p=.001$ ,  $N=332$ ,  $RMSEA=.057$  [.037, .078],  $SRMR=.060$ ,  $CFI=.950$ , Yuan-Bentler scaling correction factor=1.006). Notably, a likelihood ratio test suggested no significant decrease in model fit ( $\Delta\chi^2=5.5276$ ,  $\Delta df=4$ ,  $p=.2373$ ), suggesting the more parsimonious model with no direct pathways between the psychological variables and Brexit attitudes (i.e. assuming a full mediatory role for the ideological variables) was preferred.



**Figure 2.3. Structural equation model predicting support for Brexit.** All parameters shown are fully standardized. Significant parameter estimates are shown in green and red bolded lines. Residual covariances between psychological variables and between ideological variables are allowed, but not shown for simplicity. Significance level was  $p < .05$ . Sig. Neg. = significant negative pathway, Sig. Pos. = significant positive pathway, N.S.=not significant, L1 = Level 1 (Psychological Flexibility variables), L2 = Level 2 (Ideological Orientation variables), L3 = Attitude outcome variable, WCST=Wisconsin Card Sorting Test accuracy, RAT=Remote Associates Test accuracy. Figure design inspired by Kievit and colleagues (2014, 2016).

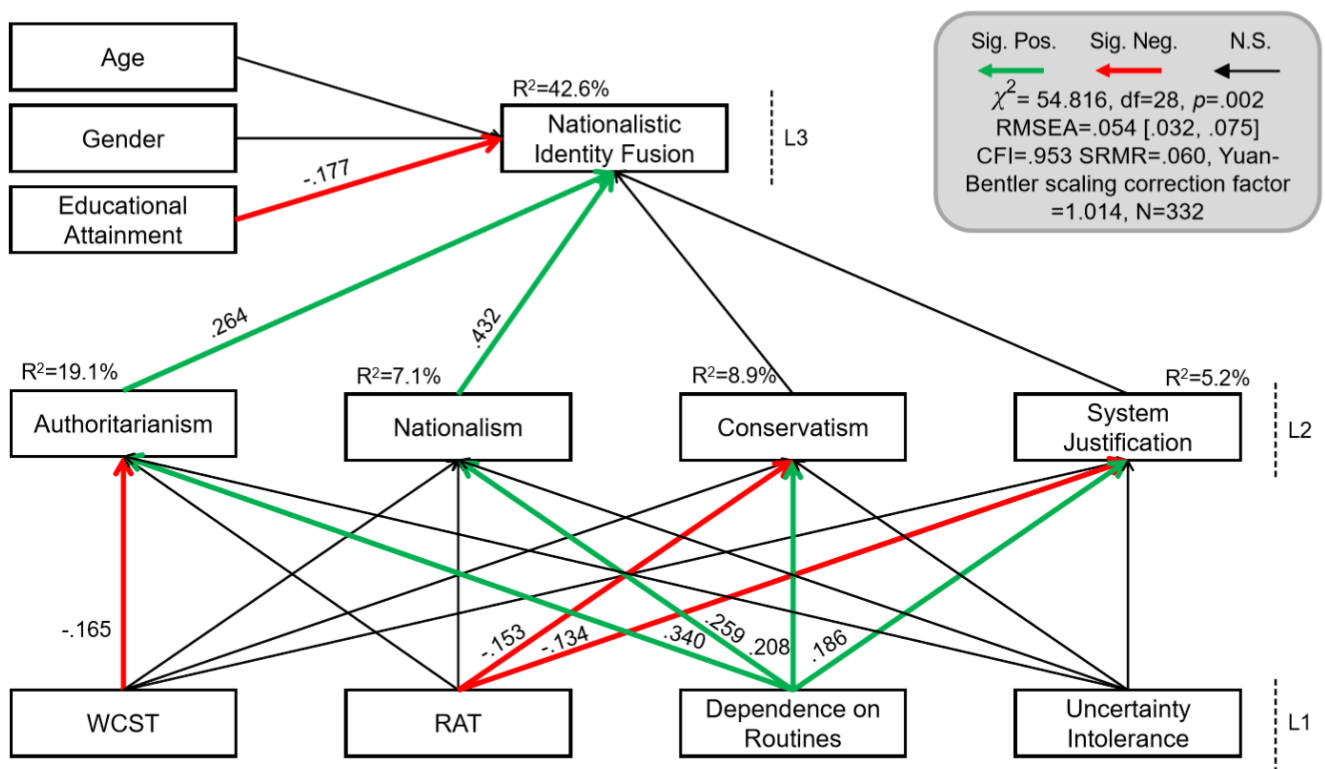
As shown in Figure 2.3, this model explains 47.6% of the variance in pro-Brexit attitudes ( $R^2=43.6\%$  without the demographic covariates). The model suggests that reduced cognitive and subjective flexibility contribute towards a more authoritarian, conservative, nationalistic ideological orientation, which in turn is predictive of support for the UK's exit from the EU. Out of the ideological orientation variables in Level 2, the strongest predictors (as indexed by standardized pathways) of Brexit support were nationalism, authoritarianism, and conservatism. Each of these variables made significant, and complementary, contributions to the prediction of Brexit support, and each ideological variable in turn was predicted by a unique combination of the cognitive and subjective flexibility variables. A stronger

dependence on daily routines was a significant predictor of all the ideological variables in Level 2, indicating that reduced subjective flexibility may contribute to an ideological orientation that is more authoritarian, nationalistic, conservative, and system-justifying. Notably, while poor WCST performance significantly predicted authoritarianism and nationalism, poor RAT performance significantly predicted conservatism. This indicates that these cognitive flexibility measures have selective and specific effects on different ideological variables, and so certain types of cognitive inflexibility may contribute to particular forms of ideological thinking.

In this model, system justification was not a significant predictor of Brexit support. To examine this further, we fit a model in which the pathways between pro-Brexit attitude and authoritarianism, nationalism, and conservatism are constrained to 0, while the pathway between pro-Brexit attitude and system justification was estimated freely. This suggested that system justification is predictive of support for Brexit (unstandardized estimate=1.022, SE=.186, standardized estimate=.340,  $p<.001$ ), but its variance is accounted for by the other ideological variables, such that it is associated with Brexit support but does not predict above and beyond authoritarianism, nationalism, and conservatism.

To validate and extend this model further, we fit the original parsimonious model (Figure 2.3) but with different Brexit-related attitudes, including opposition to immigration, the EU, and free movement of labour (Figures 2.5-2.6). Across all these attitude measures, a model in which the effects of the psychological variables on the attitude outcome variable were mediated through the ideological measures had good model fit to the data and was more parsimonious and had equivalent model fit to a model which allowed direct pathways between the psychological variables and the attitude to be freely estimated (see Figures 2.5-2.6). These models revealed the same pathway patterns between the psychological, ideological, and attitude outcome variables as in the original model predicting Brexit support (Figure 2.3), with only slight variations in the parameter estimates. Overall, all three models found that cognitive and subjective inflexibility were predictive of a more authoritarian and nationalistic ideological orientation, which in turn significantly predicted Brexit-

related attitudes ( $R^2$  varied between 40.4% and 45.5% with the demographic covariates, and between 39.0% and 43.2% without the demographic covariates). The only differences between the models were the predictive power of the demographic variables (e.g. age was not a significant predictor of opposition to the EU and freedom of labour movement), the predictive power of conservatism (conservatism was predictive of Brexit support and opposition to immigration, but not of opposition to the EU and freedom of labour movement), and the significance levels of the pathway between WCST performance and nationalism (which varied between  $p=.043$  and  $p=.055$ , suggesting at best a borderline effect).



**Figure 2.4. Structural equation model predicting nationalistic identity fusion** All parameters shown are fully standardized. Significant parameter estimates are shown in green and red bolded lines. Residual covariances between psychological variables and between ideological variables are allowed, but not shown for simplicity. Significance level was  $p < .05$ . Sig. Neg. = significant negative pathway, Sig. Pos. = significant positive pathway, N.S. = not significant, L1 = Level 1 (Psychological Flexibility variables), L2 = Level 2 (Ideological Orientation variables), L3 = Attitude outcome variable, WCST = Wisconsin Card Sorting Test accuracy, RAT = Remote Associates Test accuracy. Figure design inspired by Kievit and colleagues (2014, 2016).

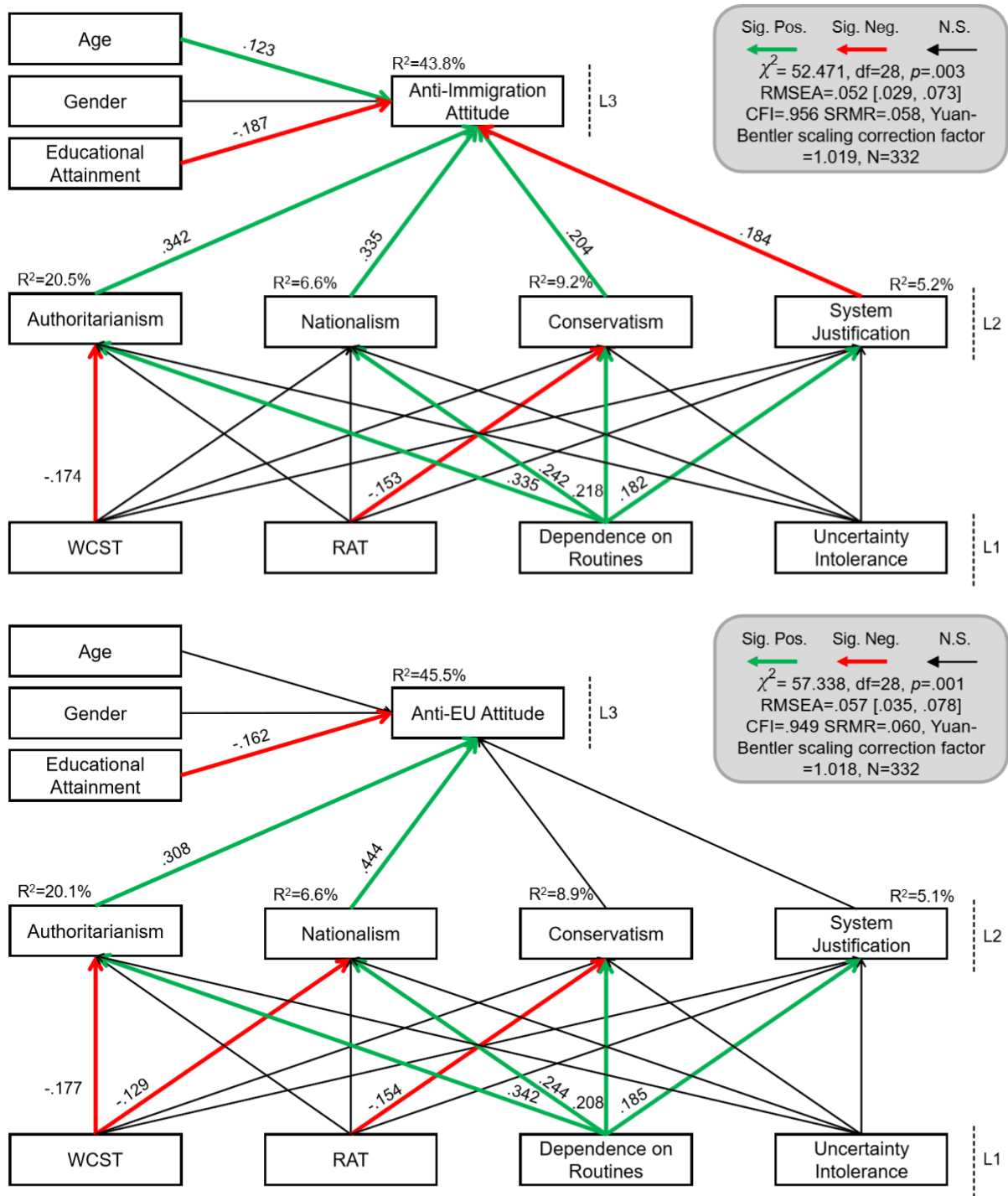
Furthermore, to establish that the fit of these models was not merely due to a general feature of the variable covariance matrix, we conducted control analyses to assess the hierarchical structure of these models. An additional model was fitted in which Level 1 and Level 2 were reversed, and so pro-Brexit attitude was regressed on the psychological variables, which in turn were regressed on the ideological variables. This control model therefore consisted of the same information as the original model (depicted in Figure 2.3), and has equivalent complexity, but assumes a different structural relationship between the variables. As in the original model, residual covariances were allowed within levels but not between levels, and there were no direct pathways between the ideological variables and the Brexit attitude measure. The original model fit the data significantly better than this inverted model ( $\Delta\text{AIC}=129.175$ ). Notably, the original model structure was also a consistently better fit than the inverted model when the outcome variables were opposition to immigration ( $\Delta\text{AIC}=97.341$ ), the EU ( $\Delta\text{AIC}=117.468$ ), and free movement of labour ( $\Delta\text{AIC}=92.729$ ).

So far, the fitted structural equation models demonstrated the contribution of psychological flexibility to ideological orientations that support Brexit and oppose immigration, the EU, and free movement of labour. In addition to these policy-oriented attitudes, it is valuable to test whether this model would predict participants' sense of nationalistic identity and how personally "fused" they feel with the concept of the UK. We therefore followed the same analytic procedure and fitted the original model structure to participants' nationalistic identity fusion scores. First, we fit a three-level model in which the direct paths between the psychological variables and nationalistic identity fusion were freely estimated, and residual covariances were allowed within levels but not between levels. This model demonstrated good fit to the data ( $\chi^2=52.882$ ,  $df=24$ ,  $p=.001$ ,  $\text{RMSEA}=.060$  [.038, .082],  $\text{SRMR}=.058$ ,  $\text{CFI}=.950$ , Yuan-Bentler scaling correction factor=.998). Next, we constrained the direct paths between the psychological variables and the nationalistic identity fusion to 0, such that the model structure assumed the effect of the psychological variables on identity fusion was fully mediated through the ideological variables. This model also possessed good model fit ( $\chi^2=54.816$ ,  $df=28$ ,  $p=.002$ ,  $\text{RMSEA}=.054$  [.032, .075],  $\text{SRMR}=.059$ ,  $\text{CFI}=.950$ ).

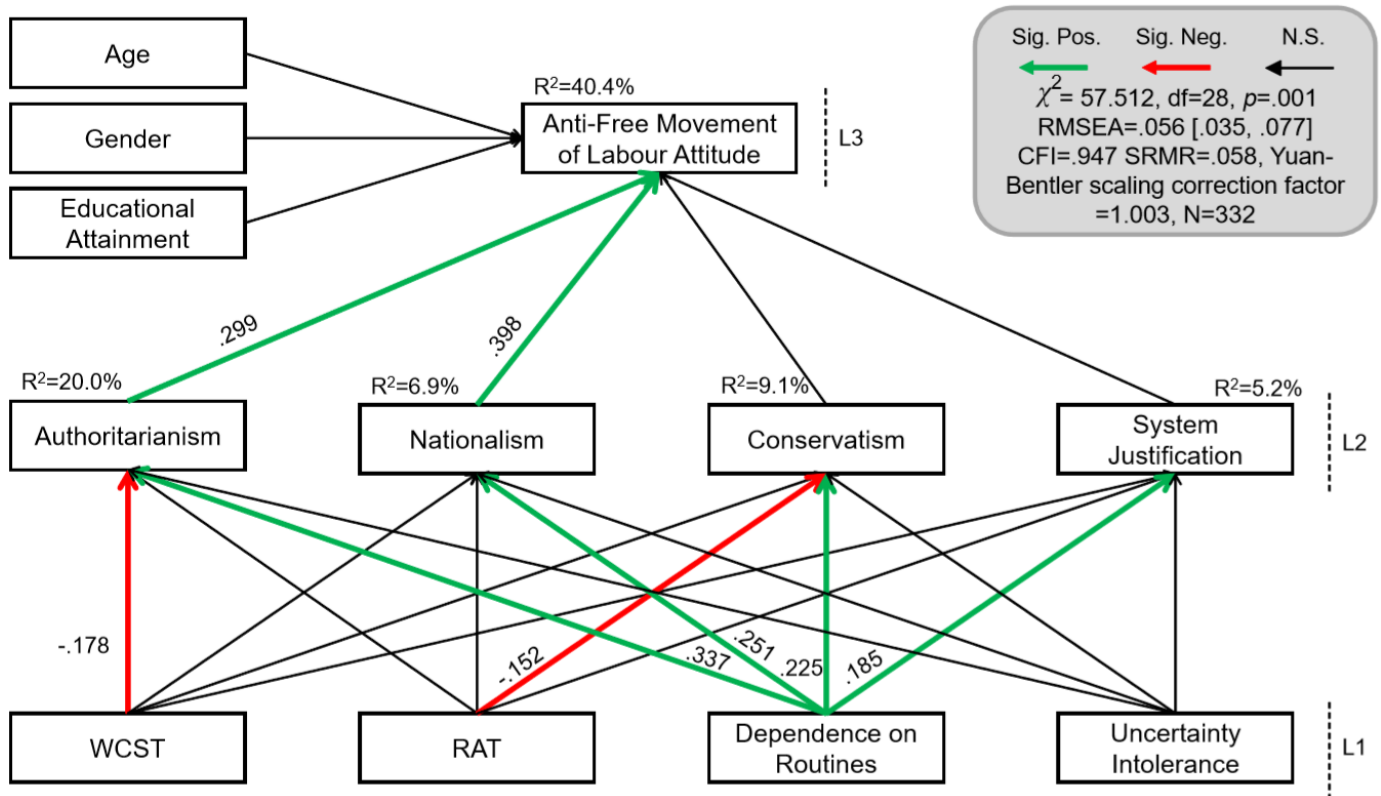


.953, Yuan-Bentler scaling correction factor =1.014) and accounted for 42.6% in the variance in nationalistic identity fusion (Figure 2.4). Comparison of these two models showed no significant difference in model fit ( $\Delta\chi^2=2.5181$ ,  $\Delta df=4$ ,  $p=.6414$ ), and so the latter, more parsimonious model, which assumed no direct pathway between the psychological variables and identity fusion, was preferred. Moreover, when this parsimonious model was compared to a control inverted model in which Level 1 (the psychological variables) and Level 2 (the ideological variables) were reversed, the original parsimonious model possessed a more favourable model fit and structure than its inverted counterpart ( $\Delta AIC=108.228$ ).

As evident in Figure 2.4, the pattern of results for the model predicting nationalistic identity fusion was similar to the models predicting policy-oriented Brexit attitudes, as poor performance on the objective cognitive flexibility measures and a stronger dependence on daily routines predicted a more ideological thinking style which in turn contributed to participants' sense of identity fusion and "oneness" with the UK relative to Europe. Consequently, policy preferences as well as sense of identity are shaped by ideological orientation and cognitive styles.



**Figure 2.5. Structural equation model predicting opposition to immigration (top) and EU (bottom).** All parameters shown are fully standardized. Significant parameter estimates are shown in green and red bolded lines. Residual covariances between psychological variables and between ideological variables are allowed, but not shown for simplicity. Significance level was  $p < .05$ . Sig. Neg. = significant negative pathway, Sig. Pos. = significant positive pathway, N.S.=not significant, L1 = Level 1 (Psychological Flexibility variables), L2 = Level 2 (Ideological Orientation variables), L3 = Attitude outcome variable, WCST=Wisconsin Card Sorting Test accuracy, RAT=Remote Associates Test accuracy.



**Figure 2.6. Structural equation model predicting opposition to free movement of labour.** All parameters shown are fully standardized. Significant parameter estimates are shown in green and red bolded lines. Residual covariances between psychological variables and between ideological variables are allowed, but not shown for simplicity. Significance level was  $p < .05$ . Sig. Neg. = significant negative pathway, Sig. Pos. = significant positive pathway, N.S. = not significant, L1 = Level 1 (Psychological Flexibility variables), L2 = Level 2 (Ideological Orientation variables), L3 = Attitude outcome variable, WCST = Wisconsin Card Sorting Test accuracy, RAT = Remote Associates Test accuracy.

## 2.4 Discussion

The present study found that adoption of strongly nationalistic attitudes in the context of the EU Referendum was related to reduced psychological flexibility across multiple objective and subjective measures (Figures 2.1 & 2.2, Table 2.1). Support for Brexit was associated with ideological orientations that were significantly more authoritarian, nationalistic, conservative, and system-justifying. Moreover, structural equation modelling revealed that reduced subjective and objective cognitive flexibility contribute towards more authoritarian, nationalistic, and conservative ideological orientations, which in turn predict support for Brexit and opposition to immigration, the EU, and free movement of labour. The models accounted for a significant proportion of variance in pro-Brexit attitudes (44.3% on average across the measured attitudes; Figures 2.3, 2.5, and 2.6). Building on the re-emergence of nationalistic sentiments in Europe and the USA in 2016 and 2017, this investigation was able to offer a novel outlook on the psychology behind nationalistic identity in the context of Brexit. From a methodological perspective, assessing cognitive flexibility using objective performance-based neuropsychological measures, and complementing these with self-report measures, allowed us to explore the psychological processes underpinning ideological cognition and voting behaviour. Interestingly, this path analysis model structure also accounted for participants' sense of identity fusion with the UK (Figure 2.4), as assessed via a pictorial measure. Consequently, cognitive and subjective inflexibility contribute towards ideological thinking styles that shape both policy-oriented nationalistic attitudes and sense of personal nationalistic identity.

Notably, the two objective cognitive flexibility tasks were ideologically- and emotionally-neutral, and so did not tap information processing specific to nationalistic ideologies or any form of social cognition. Although nationalism and voting have long been coupled with emotional processing (Jost, Hennes, & Lavine, 2013; Feldman, Huddy, & Cassese, 2012), and many studies in political psychology have investigated individuals' responses to negative and threatening stimuli (Inbar, Pizarro, & Bloom, 2009; Smith et al., 2011; Carraro, Castelli, & Macchiella, 2011), it may not only be 'hot' cognition - i.e. emotion-dependent information processing (Lodge & Taber, 2005;

Roiser & Sahakian, 2013) – that is relevant to the adoption of ideologies. In this study, we showed that ‘cold’ cognition – i.e. information processing that is emotionally-neutral – can also be implicated in individual differences in adherence to ideologies. This provides empirical support to the idea that the rigidity of our belief systems is not purely a matter of emotion and attitude-confirming biases, but can also be related to cognitive information processing styles that are not explicitly linked to our moral foundations, beliefs, and values.

Indeed, this builds upon earlier work demonstrating links between neurocognitive functioning and political ideologies. For example, Amodio and colleagues (2007) illustrated that neurocognitive sensitivity to response conflict is correlated with a more liberal political orientation, and Shook and Fazio (2009) provided evidence that learning strategies in the exploration of novel non-ideological stimuli were related to political ideology. Hence, there is value in expanding the use of cognitive methods for studying the psychological roots of ideology.

The present findings also reveal notable specificities in the pathways between psychological flexibility and Brexit attitudes. As evident in Figure 2.4, the effect of WCST performance on pro-Brexit attitudes is mediated via its effect on nationalism and authoritarianism, while the effect of RAT performance is mediated through heightened conservatism. This signifies that the pathways between objective cognitive flexibility, ideological orientations, and nationalistic policy attitudes vary according to the facet of cognitive flexibility under investigation. Consequently, certain facets of psychological inflexibility are associated with specific types of conservative-leaning ideologies. This yields two valuable insights: firstly, cognitive flexibility is a multidimensional construct that both social and cognitive psychology researchers will need to further unpack. Secondly, there are subtle differences in the cognitive correlates of different types of ideological thinking, and so future research will need to address the mechanisms underlying these differential relationships and explore what these psychological correlates can tell us about the differences between authoritarianism, nationalism, conservatism, and system justification, amongst other ideological orientations. Furthermore, while dependence on routines and traditions in

daily life was predictive of all four ideological orientations, intolerance for uncertainty was not a significant predictor of any of these. This suggests that a preference for habits and repetitive routines may foster a preference for ideologies that emphasize traditionalism and predictability. However, it is conceivable that immersing oneself in strongly ideological environments may also encourage psychological inflexibility and promote a preference for routines and traditions. Nevertheless, more research is necessary to understand the nature of cognitive flexibility and the various ways in which it manifests in relation to ideological thinking.

This research program builds on and complements previous work in four overarching theoretical frameworks: (1) the nature of nationalistic attachment, (2) political conservatism as motivated social cognition, (3) System Justification Theory, and (4) Identity Fusion Theory. Previous studies of nationalistic attachment have typically distinguished multiple dimensions of nationalism (Sidanius, Feshbach, Levin, & Pratto, 1997), such as a distinction between nationalism and patriotism (Kosterman & Feshbach, 1989, De Figueiredo & Elkins, 2003; Wagner et al., 2010), between blind and constructive patriotism (Schatz et al., 1997, 1999), and between collective narcissism and positive group regard (Golec de Zavala, Cichocka, & Bilewicz, 2013). Future research should therefore fractionate nationalism further and investigate whether patriotism conceptualized as love of one's country, rather than nationalistic views on separateness and superiority, have different cognitive correlates.

Furthermore, these findings are relevant for the literature on the relationship between right-wing conservatism and cognitive style (Jost et al., 2003a; Jost, 2017; Van Hiel et al., 2016; Van Hiel, Onraet, & De Pauw, 2010), as the results indicate negative relationships between right-wing conservatism and objective cognitive flexibility in the WCST and RAT (Table 2.1, Figure 2.3). Interestingly, in the structural equation models (Figures 2.3 & 2.4), conservatism was predicted by RAT (and not WCST) performance and greater dependence on routines, and so it is important to address the specificities in the relationship between right-wing conservatism and objectively-assessed cognitive flexibility.

Recent interpretations of System Justification Theory (Jost & Banaji, 1994) have posited that national attachment may be a means of attaining the system justifying goal to defend existing social systems against criticism (Van der Toorn et al., 2014). Indeed, the present study found significant correlations between system justification and nationalistic attitudes and attachment (Table 2.1). However, system justification did not account for nationalistic attitudes above and beyond the other ideological orientation variables in the model (authoritarianism, conservatism, and nationalism), and was in fact a significant negative predictor of anti-immigration attitudes (Figure 2.5). Additionally, System Justification Theory proposes that justifying the prevailing systems is psychologically appealing because it facilitates the attainment of certainty and coherence, and reduces feelings of threat and inconsistency (Hennes et al., 2012; Jost, Ledgerwood, & Hardin, 2008). Here, system justification was negatively correlated with RAT performance (Table 2.1, Figure 2.4), signifying that these epistemic motivations may operate more deeply than the social-psychological level, and may related to cognitive predispositions towards inflexible thinking that could make some individuals more susceptible to these epistemic and existential motivations.

Finally, these findings are also relevant for Identity Fusion Theory (Swann et al., 2010). Extending previous work showing that strong identity fusion is related to extreme pro-group actions (Swann et al., 2009) and sacrificial behaviours across different cultures (Swann et al., 2014; Whitehouse et al., 2014; Fredman, Bastian, & Swann, 2017), here we find that identity fusion also captures individual variation in normative intragroup and intergroup attitudes and is related to psychological flexibility. Most interestingly, the results indicate that heightened fusion with the nationalistic ingroup is related to poorer WCST performance (Table 2.1), suggesting that more cognitively flexible individuals have a reduced tendency to selectively fuse with their national ingroup. Moreover, Whitehouse and Lanman (2014) proposed that rituals are key components of identity fusion, and correspondingly we found that individuals who reported depending on rituals and routines in their daily lives, and who believed that rituals are important even when unpleasant, were more fused to their nation (Table 2.1). Note that the rituals and routines that participants reported

about were personal rather than collective, suggesting that dispositional propensities towards ritual engagement may play an essential role in shaping susceptibility to identity fusion.

The finding that both behavioural and self-report measures of psychological flexibility made significant unique and independent contributions to ideological thinking and Brexit-related attitudes supports other empirical work on prejudice (e.g. De keersmaecker et al., 2017a) and methodological considerations about how best to measure these constructs (Jost, 2017; Van Hiel et al., 2016; Onraet et al., 2015). Furthermore, this study was not meant to be an exhaustive investigation of all the facets of psychological flexibility or cognitive style (for further discussions into the cognitive flexibility construct see: Schaie, Dutta, & Willis, 1991; Kozhevnikov, 2007; Cools & Robbins, 2007; Kehagia, Murray, & Robbins, 2010), and so there is room for further elucidation of the relationships between various ideological orientations and flexibility.

By investigating the cognitive roots of ideological thinking and nationalistic attitudes and behaviour, this study has sought to connect the realm of cognition with that of ideology. Ideologically-neutral cognitive flexibility was found to be an important correlate of ideological identity and behaviour, suggesting that flexibility of thought may have far-reaching consequences for social and political attitudes. The way the brain constructs internal boundaries between conceptual representations and adapts to changes in environmental contingencies has been shown here to be linked to their desire for external boundaries to be imposed on national entities and for greater homogeneity in their cultural environment. This illustrates that information processing styles in relation to perceptual and linguistic stimuli may also be drawn upon when dealing with political and ideological information. Thus, it is not only emotional processing or “psychological needs” that underlie individuals’ adoption of nationalistic ideologies; “cold” cognitive information processing styles also play a key role in ideological behaviour and identity. Nevertheless, these findings do not rule out the possible effects of immersing oneself in ideologies on psychological flexibility and cognition, and so future research will need to address these complex causal



relationships and interactions (Jost, Nam, Amodio, & Van Bavel, 2014). Acknowledging the importance of linking individual differences at the level of perception and cognition with differences at the level of identity and political behaviour will help to further inform our understanding of the *cognitive* underpinnings of ideology.



# 3

## **Chapter 3**

### Cognitive Flexibility and Religious Disbelief: The Roles of Ideological Rituals, Identity, and Upbringing



# 3 Cognitive Flexibility and Religious Disbelief: The Roles of Ideological Rituals, Identity, and Upbringing

## 3.1 Introduction

The last decade has seen the birth of a new field, the ‘cognitive science of religion’ (Boyer, 2008; Whitehouse, 2004), which has illustrated that religious beliefs and traditions originate from ordinary psychological functions (Banerjee & Bloom, 2014; Heywood & Bering, 2014; Norenzayan & Gervais, 2013; Norenzayan, 2016). There is a range of human cognitive biases that are thought to make children and adults “intuitive theists” (Järnefelt, Canfield, & Kelemen, 2015; Kelemen, 2004; Kelemen & Rosset, 2009). These include human tendencies towards anthropomorphism (Epley, Waytz, & Cacioppo, 2007) and teleological thinking (Banerjee & Bloom, 2014; Heywood & Bering, 2013), which may give rise to specific religious beliefs about supernatural agents and creationism (Norenzayan, 2016).

Notably, however, research on the links between religious beliefs and cognitive processes has been largely motivated by researchers’ interest in the *content* of religious beliefs, that is, in why religions tend to depict supernatural agents or include beliefs about agentic, omniscient, and punishing gods (Norenzayan, 2016). Nevertheless, there has been little scientific attention to how the *strictness* of religious ideologies – regardless of the content of their doctrine – might also be rooted in and have consequences for cognition.

The building blocks of religious belief systems consist of strict rules and rituals that offer adherents a sense of coherence and certainty and a firm knowledge structure about the world (Atran, 2002; Kay et al., 2008, 2009; McCullough & Willoughby, 2009; Rutjens et al., 2010; Epley et al., 2007; Dechesne et al., 2003; Norenzayan & Hansen, 2006; Vail et al., 2010). Despite the proliferation in academic research into the cognitive, affective, and moral underpinnings of religiosity (Norenzayan, Shariff, & Gervais, 2016; Purzycki et al., 2016; Rand et al., 2014; Kapogiannis et al., 2009, 2014;

Pennycook et al., 2012), two important questions have not been addressed empirically: firstly, given the strictness of many religious ideologies, to what extent does religious adherence and practice of repetitive religious rituals shape the persistence versus flexibility of one's cognition? And secondly, to what extent does early religious upbringing shape later cognitive persistence and flexibility?

When facing dynamically changing environments, human goal-directed action is thought to be characterized by a conflict between two antagonistic cognitive modes (Goschke, 2003; Dreisbach & Goschke, 2004; Hommel, 2015). On one hand, goal-directed behaviour requires that stable goals are maintained and that these are shielded from irrelevant information or competing goals. That is, it is adaptive to have an orientation towards *cognitive persistence*. On the other hand, behaviour must remain sensitive to alternative possibilities, to disengage from ineffective goals, and to flexibly adapt when environments or internal states change. Goal-directed behaviour therefore also benefits from *cognitive flexibility*. These two cognitive control modes serve antagonistic adaptive functions and have complementary advantages and disadvantages (Goschke & Bolte, 2014). Excessive shielding of goals against distraction or competing responses through cognitive persistence enhances stability, but can give rise to inflexible perseverative behaviour. In turn, excessive flexibility and behavioural switching may lead to unproductive distractibility.

Notably, individuals differ in their cognitive control tendencies towards persistence or flexibility, and there is evidence that genetic and cultural factors shape these cognitive control preferences (for review see: Hommel & Colzato, 2017). Given that religious ideologies tend to possess firm and persistent representations of how the world is structured, what is good and true, and how individuals ought to behave, it is valuable to investigate the links between religion and cognitive flexibility, as well as whether growing up with strict rules for behaviour and thought shapes cognitive persistence.

Graham and Haidt (2010) drew the fruitful analogy that overemphasis on the role of belief in Gods when investigating the psychology of religions is "like focusing on the football: It seems to be where the action is, but if you stare too long at it, you

miss the deeper purpose of the game, which is the strengthening of a community” (p. 140). Indeed, a concentrated focus on the content of religious beliefs can obscure key features of religious ideologies. However, in addition to studying the community and the *social* functions of religion, it is also essential to investigate the *cognitive* functions and consequences of religions. That is, if we extend the metaphor, looking at the community still misses the complete picture because one also needs to look at how playing the game shapes the minds and brains of the players, or attracts players with particular psychological characteristics.

The present study therefore sought to investigate the extent to which tendencies towards cognitive modes of flexibility versus persistence are related to three facets of religious life: (1) religious affiliation (i.e. identifying as religious or nonreligious), (2) religious practice, and (3) religious upbringing, in a sample of diverse religious ideologies.

## 3.2 Materials and Methods

### 3.2.1 *Participants*

The sample consisted of 744 participants (55.5% female; age:  $M=36.56$ ,  $SD=13.45$ ) recruited through Amazon Mechanical Turk and social media and were financially compensated for their participation. Participants provided their informed consent in accordance with the University of Cambridge's Department of Psychology Ethics Committee. The majority of participants are US residents (92.2%), with 5.4% not residing in the US, and 2.4% preferring not to indicate. In terms of religiosity, 62.5% of the sample reported being religious ( $N=465$ ), 31.9% reported being non-religious (atheist or agnostic,  $N=237$ ), and 5.6% declined to respond or did not know ( $N=42$ ). Out of those who reported being religious, 45.8% were Protestant Christian, 26.7% were Roman Catholic, 5.8% were Jewish, 3.7% were Hindu, 1.5% were Greek or Russian Orthodox, 1.5% were Mormon, 1.1% were Muslim, and 13.7% affiliated with other religions. In terms of frequency of religious services attendance amongst religious participants, 29.7% attended 1-2 times per week, 13.1% attended 1-2 times per month, 18.6% attended 1-2 times per year, 18.4% seldom attended, and 20.2% never attended. Across all participants, 59.4% had been raised in a home described as religious.

### 3.2.2 *Measures and Procedure*

#### *Religiosity Measures*

Participants were asked the following questions, all of which were answered in a multiple-choice format with appropriate potential answers and always the option not to respond: (Q1) "What is your present religion, if any?". Participants were presented with the following response options: "Protestant (Baptist, Methodist, Non-denominational, Lutheran, Presbyterian, Pentacostal, Episcopalian, Reformed, Church of Christ, etc.)", "Roman Catholic", "Mormon", "Orthodox (Greek, Russian, or some other orthodox church)", "Muslim", "Jewish", "Hindu", "Jehova's Witness", "Atheist (do not believe in God)", "Agnostic (not sure if there is a God)", "Don't know", "Would rather not say", "Other" (with option to fill in text). (Q2) "As a child,



were you raised in a religious home?”. Participants could select between: “Yes”, “No”, “Don’t know”. (Q3) “Aside from weddings and funerals, how often do you attend religious services?”. Participants could select between the following responses: “More than once a week”, “Once a week”, “Once or twice a month”, “A few times a year”, “Seldom”, “Never”.

#### *Wisconsin Card Sorting Test (WCST)*

The WCST (Grant & Berg, 1948) was administered with Inquisit 5 by Millisecond Software in standard fashion (Heaton, 1981). Participants are presented with four key cards and a deck of response cards that vary on three dimensions (colour, shape, and number of geometric figures) and are asked to match a fifth card from the sequentially-presented response cards to one of the four key cards. Participants need to identify the correct classification rule (out of three potential rules: matching by colour, shape, or number) according to the feedback they receive after each trial. They are informed that the classification rule may change without warning, and indeed the rule alternates after participants correctly respond to ten consecutive trials, requiring a flexible set shift. The task ends after participants complete six categories (twice for each of the three rules) or after 128 trials. To index participants’ performance, the WCST accuracy rate was computed.

#### *Remote Associates Test (RAT)*

The RAT (Mednick, 1968) consisted of 15 compound remote associate problems, in which participants are presented with three cue words (e.g. *cottage*, *swiss*, and *cake*), and must generate the compound word solution that connects these three words (e.g. *cheese*). Items of varying difficulty levels were selected from established remote associate problems (Bowden & Jung-Beeman, 2003). Participants were given 20 seconds to respond to each item.

#### *Alternative Uses Task (AUT)*

In the AUT (Guilford, 1967), participants were asked to generate as many possible uses for two common household items (brick and newspaper) for 2 minutes. Participants’ responses were recorded and scored along four components by two

independent raters in accordance with previous guidelines (Cronbach's  $\alpha = .994$ ; Chermahini & Hommel, 2010; Madore et al., 2015; Roberts et al., 2017). Flexibility was scored according to the number of distinct categories that participants' responses for a given item could be clustered into (e.g. using a newspaper for making origami and making paper dolls are uses that would fall under the same category of arts and crafts, while using a brick for swatting a fly would fall under a separate category). The total flexibility score comprised of the sum from all trials. Fluency constituted the total number of appropriate responses. Elaboration reflected the amount of detail provided by the participants (for brick, "build" would receive a score of 0; "build a house" would receive a score of 1; and "a weapon to protect family when your house is robbed" would be awarded 2 points for specifying detailed use and context). To score originality, each response was compared to the responses from the rest of the participants, such that responses to a given object that were only provided by 5% of the sample received an originality point. The total originality score reflected the sum of original scores per participant across all trials. To establish interrater reliability for appropriate categories, level of detail for the elaboration scoring, and originality, the raters separately scored 25 random participants' responses, and once high interrater reliability was established with this set on all AUT measures (Cronbach's  $\alpha > 0.91$  on all measures), the raters independently scored the rest of the participants. Each AUT measure reflects the mean score given by the two independent raters.

#### *Additional Measures*

Additional measures that were included in this study but are not reported here included: political affiliation and conservatism (Everett, 2013), identity fusion (Swann et al., 2009; Jimenez et al., 2016) and support for extreme pro-group actions (Swann et al., 2010). The findings associated with these measures are reported and published elsewhere.

### 3.3 Results

Correlational analysis revealed significant positive correlations between the three cognitive flexibility measures:  $r=.135$  ( $p=.010$ ) between WCST and RAT,  $r=.176$  ( $p<.001$ ) between AUT Flexibility and RAT, and  $r=.289$  ( $p<.001$ ) between WCST and AUT Flexibility. Given the different demands that each of these tasks makes on participants' working memory, perception, and linguistic skills, this corroborates past work suggesting that these three measures are related but separable facets of flexible cognition (e.g. Eslinger & Grattan, 1993; Parkin & Lawrence, 1994).

In terms of the relationship between the cognitive flexibility measures and demographic variables, age was positively correlated with RAT performance,  $r=.138$  ( $p<.001$ ), but not with WCST,  $r=-.049$  ( $p=.331$ ), or AUT Flexibility,  $r=-.051$  ( $p=.186$ ). Educational attainment was not correlated with any of the three measures: WCST,  $r=.017$  ( $p=.737$ ); RAT,  $r=.057$  ( $p=.146$ ), and AUT Flexibility,  $r=.031$  ( $p=.420$ ). There were also no differences according to gender on the three measures: WCST,  $t(393)=-.013$  ( $p=.990$ ); RAT,  $t(639)=1.440$  ( $p=.150$ ), and AUT Flexibility,  $t(671)=-.325$  ( $p=.745$ ).

An independent samples t-test demonstrated there was a significant difference in the age of religious participants ( $M=37.83$ ,  $SD=13.44$ ,  $N=447$ ) and nonreligious participants ( $M=34.07$ ,  $SD=12.89$ ,  $N=235$ );  $t(680)=-3.516$ ,  $p<.001$ . A Chi-Square Test demonstrated an association between gender and religious affiliation,  $\chi^2(1)=12.538$ ,  $p<.001$ , such that females tended to be more religious than males. There were no differences in educational attainment of religious and nonreligious participants,  $t(687)=-1.086$ ,  $p=.278$ .

In order to make sure that any detected differences in cognitive flexibility according to religiosity are not due to differences in these demographic variables, the variables of age, gender, and educational attainment were included as covariates in all analyses, unless otherwise stated. Furthermore, since not all participants completed the WCST, the ANCOVAs and Bonferroni corrections are reported separately for each of the cognitive flexibility measures, so that each analysis reflects the full number of participants who completed that cognitive flexibility measure.

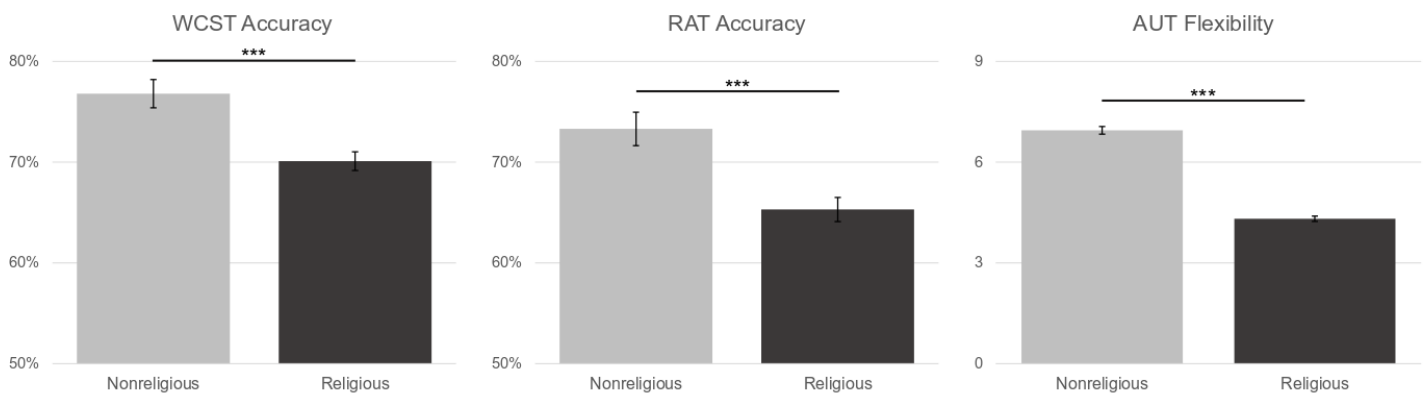
### 3.3.1 Religious Affiliation and Flexibility

Univariate ANCOVAs were computed on measures of cognitive flexibility, with age, gender, and educational attainment as covariates, and religious versus nonreligious identity as the fixed factor. An ANCOVA on WCST accuracy rate revealed a significant main effect of religious identity,  $F(1,368)=15.425$ ,  $p<.001$ ,  $\eta_p^2=.040$ , such that nonreligious participants ( $N=114$ ) possessed higher scores on the WCST overall than religious participants ( $N=259$ ) (see Figure 3.1). There were no significant effects of age, gender, or educational attainment. The effects of religious affiliation on WCST remain unaffected when the analysis is conducted without inclusion of the covariates:  $F(1,379)=17.238$ ,  $p<.001$ ,  $\eta_p^2=.044$ .

This pattern of results was also evident in the ANCOVA on RAT accuracy rate,  $F(1,594)=14.686$ ,  $p<.001$ ,  $\eta_p^2=.024$ : as seen in Figure 3.1, nonreligious participants ( $N=208$ ) provided more correct answers on the RAT than religious participants ( $N=391$ ). There was a main effect of age for RAT performance,  $F(1,594)=14.141$ ,  $p<.001$ ,  $\eta_p^2=.023$ , with older participants scoring more highly on the RAT. There were no statistically significant effects of gender or educational attainment. The effects of religious affiliation on RAT performance remain unaffected when the analysis is conducted without inclusion of the covariates:  $F(1,607)=9.066$ ,  $p=.003$ .

A MANCOVA on the four AUT measures, with age, gender, and educational attainment as covariates, and religious versus nonreligious identity as the fixed factor, found a significant main effect of religious identity for the AUT Flexibility score,  $F(1,623)=352.987$ ,  $p<.001$ ,  $\eta_p^2=.362$ , and the AUT Originality score,  $F(1,623)=69.855$ ,  $p<.001$ ,  $\eta_p^2=.101$ , but not for the AUT Elaboration score,  $F(1,623)=.047$ ,  $p=.829$  or AUT Fluency score,  $F(1,623)=2.405$ ,  $p=.121$  (Figure 3.1). Specifically, nonreligious participants ( $N=416$ ) provided more flexible and original responses on the AUT than religious participants ( $N=212$ ). There was no significant effect of gender ( $p=.332$ ) or age ( $p=.948$ ) for the AUT Flexibility score, and a small significant effect of educational attainment,  $F(1,623)=4.846$ ,  $p=.028$ ,  $\eta_p^2=.008$ , with higher educational attainment relating to more flexible scores. For the AUT Originality score, there was no significant effect of age ( $p=.992$ ) or educational attainment ( $p=.059$ ), and females provided more

original responses than males,  $F(1,623)=9.222$ ,  $p=.002$ . The effects of religious affiliation on AUT performance remain unchanged when the analyses are conducted without inclusion of the covariates: there is a significant effect for AUT Flexibility,  $F(1,623)=363.404$ ,  $p<.001$ , and AUT Originality,  $F(1,623)=64.706$ ,  $p<.001$ , and nonsignificant for AUT Elaboration,  $F(1,623)=.300$ ,  $p=.584$ , and AUT Fluency,  $F(1,623)=.870$ ,  $p=.351$ .



**Figure 3.1.** Comparison of religious and nonreligious participants on the Wisconsin Card Sorting Test (WCST), Remote Associates Test (RAT) and Alternative Uses Test (AUT) Flexibility, controlling for age, gender, and educational attainment. \*\*\* $p<.001$ , error bars denote  $1\pm$  standard error.

### 3.3.2 Religious Practice and Flexibility

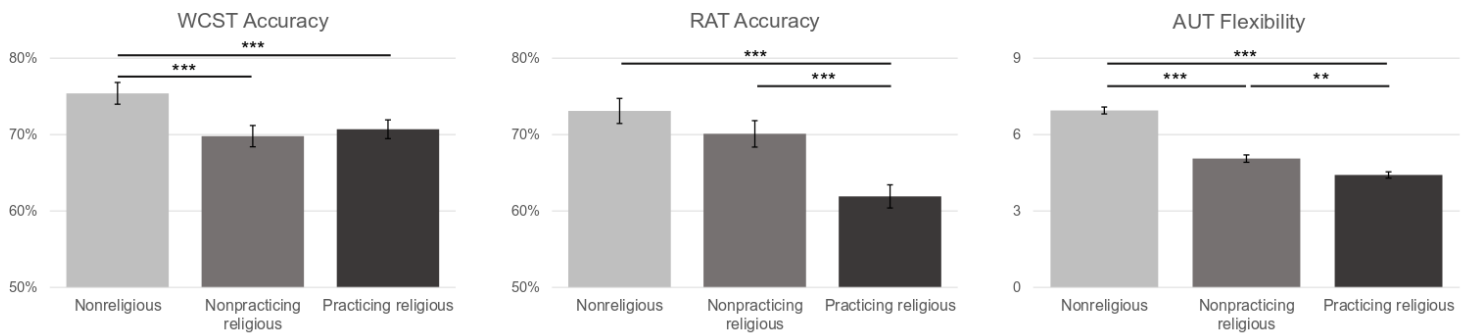
Participants were split into three groups according to their response to the question of frequency of religious service attendance: (1) nonreligious participants, (2) religious participants who regularly attend religious services (between multiple times per week to multiple times per year), and (3) religious participants who seldom or never attend religious services aside from weddings and funerals. Univariate ANCOVA, with age, gender, and educational attainments as covariates, showed significant differences between the three groups on the WCST,  $F(2, 384)=7.548$ ,  $p=.001$ ,  $\eta_p^2=.038$ , such that nonreligious participants ( $M=76.78\%$ ,  $SD=10.56\%$ ,  $N=114$ ) performed significantly better than both practicing religious participants ( $M=70.77\%$ ,  $SD=16.68\%$ ,  $N=151$ ) and non-practicing religious participants ( $M=69.72\%$ ,

SD=15.12%, N=125), and there were no significant differences between the two groups of religious participants (see Figure 3.2), as confirmed with post-hoc Bonferroni correction. There was no significant effect of age, gender, or educational attainment ( $p>.250$ ). However, when splitting the practicing religious participants according to the frequency of their religious service attendance, significant differences emerged between those that attend religious services 1-2 per week and those that attend services 1-2 per year: participants who attend religious services weekly ( $M=67.48%$ ,  $SD=17.87%$ ) performed significantly more poorly than religious individuals who attend yearly ( $M=73.95%$ ,  $SD=14.03%$ ),  $t(117)=-2.207$ ,  $p=.029$ .

Furthermore, a univariate ANCOVA on RAT accuracy rate demonstrated a main effect of religious practice,  $F(2,631)=13.935$ ,  $p<.001$ ,  $\eta_p^2=.042$ , with non-practicing religious participants ( $M=72.12%$ ,  $SD=20.89%$ ,  $N=208$ ) exhibiting significant greater cognitive flexibility on the RAT than practicing religious participants ( $M=61.87%$ ,  $SD=27.33%$ ,  $N=239$ ), and with no difference in performance between non-practicing religious participants ( $M=71.23%$ ,  $SD=21.10%$ ,  $N=190$ ) and nonreligious participants, as confirmed with Bonferroni correction. There was a significant effect of age,  $F(1,631)=10.138$ ,  $p=.002$ ,  $\eta_p^2=.016$ , and no significant effects of gender or educational attainment.

A MANCOVA on the four AUT measures demonstrated significant differences between the three groups in the AUT Flexibility score,  $F(2,662)=99.688$ ,  $p<.001$ ,  $\eta_p^2=.231$ , and AUT Originality score,  $F(2,662)=26.525$ ,  $p<.001$ ,  $\eta_p^2=.074$ , but not in AUT Elaboration,  $F(2,662)=.369$ ,  $p=.692$ , or AUT Fluency,  $F(2,662)=1.037$ ,  $p=.355$ . Nonreligious participants exhibited higher flexibility in their AUT responses than non-practicing religious participants, which in turn provided more flexible responses than practicing religious participants (Figure 3.2), after Bonferroni correction and with no significant effects of age ( $p=.519$ ), gender ( $p=.126$ ), or educational attainment ( $p=.098$ ). Similarly, nonreligious participants ( $M=8.72$ ,  $SD=3.94$ ,  $N=212$ ) offered more original responses to the AUT than non-practicing ( $p<.001$ ;  $M=6.91$ ,  $SD=4.26$ ,  $N=195$ ) and practicing ( $p<.001$ ;  $M=6.24$ ,  $SD=3.78$ ,  $N=261$ ) religious participants, but Bonferroni correction revealed there were no significant differences between non-

practicing and practicing religious participants in AUT Originality ( $p=.201$ ). There was no effect of age ( $p=.822$ ), and a significant effect of gender,  $F(1,662)=9.357, p=.002$ , and educational attainment,  $F(1,662)=4.394, p=.036$ , such that females and participants with higher levels of educational attainment offered more original responses.



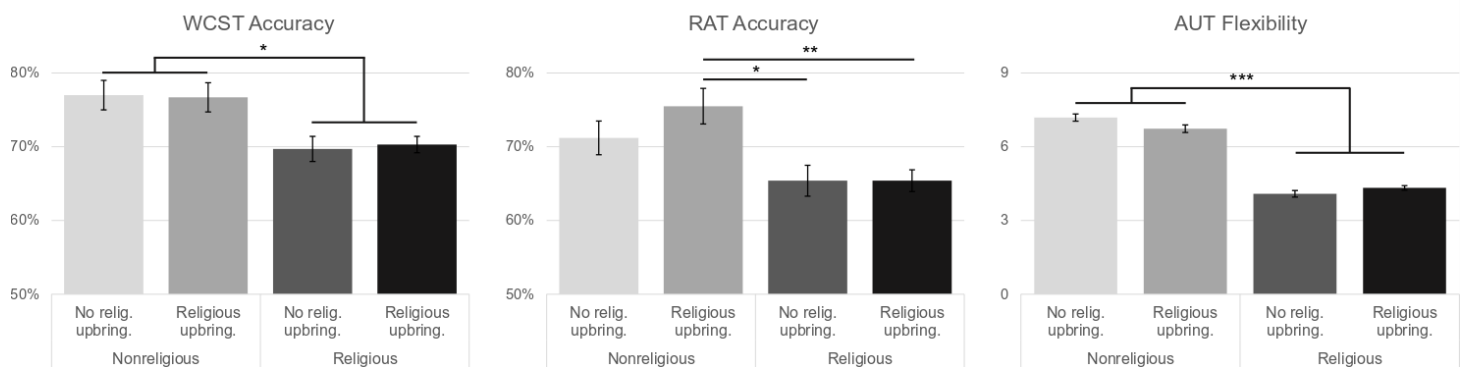
**Figure 3.2.** Comparison of nonreligious participants, religious participants who seldom or never attend religious services (nonpracticing), and religious participants who regularly attend religious services (practicing) on the Wisconsin Card Sorting Test (WCST), Remote Associates Test (RAT) and Alternative Uses Test (AUT) Flexibility, Bonferroni-corrected, controlling for age, gender, and educational attainment.  $*p<.05$ ,  $**p<.01$ ,  $***p<.001$ , error bars denote  $1\pm$  standard error.

### 3.3.3 Religious Upbringing and Flexibility

Participants were split into four groups: nonreligious individuals without a religious upbringing ( $N=109$ ), nonreligious individuals with a religious upbringing ( $N=101$ ), religious individuals without a religious upbringing ( $N=131$ ), and religious individuals with a religious upbringing ( $N=278$ ). Univariate ANCOVA, with age, gender, and educational attainment as covariates, demonstrated significant differences between groups for WCST accuracy rate,  $F(3,362)=5.207, p=.002, \eta_p^2=.041$ , where nonreligious participants performed significantly better than religious participants regardless of upbringing after Bonferroni correction. There were no significant effects of gender ( $p=.563$ ), age ( $p=.503$ ), or educational attainment ( $p=.376$ ). The same pattern of results was evident for the ANCOVA for RAT accuracy rate,  $F(3,584)=5.248, p=.001, \eta_p^2=.026$ , with nonreligious participants performing better than religious participants, as confirmed with Bonferroni correction. There was no effect of

educational attainment ( $p=.242$ ) or gender ( $p=.085$ ), but there was an effect of age ( $p<.001$ ) whereby older participants performed better on the RAT. Notably, a trend emerged in RAT performance where nonreligious participants with a religious upbringing ( $M=74.50\%$ ,  $SD=18.05\%$ ) performed better than nonreligious participants without a religious upbringing ( $M=69.70\%$ ,  $SD=23.27\%$ ), but an independent samples t-test found that this did not achieve statistical significance ( $t(207)=-1.647$ ,  $p=.095$ ).

A MANCOVA on the AUT subscores demonstrated significant differences between these four participant groups in AUT Flexibility,  $F(3,612)=141.846$ ,  $p<.001$ ,  $\eta_p^2=.410$ , and AUT Originality,  $F(3,612)=26.236$ ,  $p<.001$ ,  $\eta_p^2=.114$ , but not in AUT Elaboration,  $F(3,612)=.128$ ,  $p=.944$ , or AUT Fluency,  $F(3,612)=2.422$ ,  $p=.065$ . For both the AUT Flexibility and AUT Originality scores, nonreligious participants performed significantly better than religious participants regardless of upbringing after Bonferroni correction. As evident in Figure 3.3, nonreligious participants provided significantly more flexible responses than religious participants, with no significant effect of age ( $p=.679$ ) or age ( $p=.358$ ), and a significant effect of educational attainment,  $F(1,612)=7.774$ ,  $p=.005$ ,  $\eta_p^2=.013$ , such that higher educational attainment was related to more flexible responses in the AUT.



**Figure 3.3.** Comparison of religious and nonreligious participants with and without a religious upbringing on the Wisconsin Card Sorting Test (WCST), Remote Associates Test (RAT) and Alternative Uses Test (AUT) Flexibility, Bonferroni-corrected, controlling for age, gender, and educational attainment. \* $p<.05$ , \*\* $p<.01$ , \*\*\* $p<.001$ , error bars denote  $1\pm$  standard error. Religious upbringing.= Religious upbringing, No relig upbringing.= No religious upbringing.



### 3.4 Discussion

The present study examined the relationship between three aspects of religious life – religious affiliation, practice, and upbringing – and three psychological measures of cognitive flexibility. Overall, the results suggest that religious disbelief and reduced religious practice among religious individuals are related to heightened cognitive flexibility across three independent behavioural neuropsychological measures. In terms of religious affiliation, the findings indicate that individuals who identified as nonreligious exhibited cognitive control biases towards cognitive flexibility in the WCST, RAT and AUT, while religious individuals displayed tendencies towards cognitive persistence (Figure 3.1). With respect to WCST performance, this indicates that religious participants exhibited greater cognitive persistence while nonreligious participants demonstrated greater cognitive flexibility and did not persist with the previously-rewarded strategy when it was no longer adaptive. In terms of RAT performance, the findings signify that nonreligious individuals tended to flexibly retrieve remote associations between conceptual representations, suggesting they possess looser boundaries between representational categories in their underlying semantic networks and a tendency to restructure thought when certain semantic searches are unproductive or misleading. The same pattern was evident in the AUT, in which nonreligious participants provided responses that spanned a more flexible range of ideas and conceptual categories for possible object uses. These findings suggest that there is a relationship between cognitive flexibility and the religious ideologies to which we adhere.

In terms of frequency of religious service attendance, there were significant differences between nonreligious individuals, religious individuals who seldom or never attend religious services (non-practicing), and religious individuals who regularly attend religious services (practicing) in terms of the AUT Flexibility score (Figure 3.2). Nonreligious participants provided significantly more flexible responses than non-practicing religious participants, who in turn exhibited greater flexibility on the AUT than practicing religious participants. This linear relationship suggests that religious affiliation and religious practice may both exert an effect on the spontaneous

flexibility measured by the AUT, or that individuals who display tendencies towards spontaneous flexibility may be less likely to affiliate as religious and to engage with repetitive religious rituals. Analysis of RAT performance revealed that non-practicing religious participants exhibited the same levels of cognitive flexibility as nonreligious participants, and displayed stronger tendencies towards cognitive flexibility than practicing religious participants (Figure 3.2). This suggests that engagement and practice of religious rituals and routines may shape the semantic flexibility that underpins the RAT, or that individuals with greater flexibility on the RAT are more averse to engagement in religious rituals and services. It is striking that AUT and RAT flexibility of religious participants who regularly attend religious services differs from religious participants who do not.

The amount of religious attendance was not a differentiating factor amongst religious participants in terms of WCST performance when comparing the three groups, such that non-practicing religious participants scored the same as practicing religious participants, and both groups adopted a more persistent cognitive style than nonreligious participants (Figure 3.2). However, when studying the group of religious participants who reported attending religious services regularly, a significant difference emerged between participants who attend services 1-2 times per week and those who attend services 1-2 times per year. Participants with infrequent yearly attendance exhibited heightened cognitive flexibility in the WCST, while those who attended weekly behaved in a more cognitively persistent way, suggesting that high frequency of engagement with religious rituals and traditions is linked to greater cognitive persistence amongst practicing religious individuals in the WCST. This could imply that repetitive engagement with religious doctrine has a positive effect on cognitive persistence, or that individuals who are more cognitively persistent are more attracted to the regular practice of rituals that occurs at religious services.

Furthermore, when analysing participants' religious upbringing in relation to their current religious affiliation, it was manifest that current affiliation was more influential than religious upbringing in all of the measured facets of cognitive flexibility (Figure 3.3). Nonetheless, RAT performance indicated a trend in which

nonreligious participants who had a religious upbringing – i.e. those that choose to ‘leave’ religion in favour of atheism – were the most cognitively flexible of the four groups, including more so than nonreligious participants with no religious upbringing. While this trend did not achieve statistical significance in the current sample, it is noteworthy for future research as it could suggest that being sceptical of one’s religious doctrine and upbringing requires significant cognitive flexibility – more so than is required to remain within one’s familiar ideologies. The finding that there are significant differences in cognitive control styles between those who chose to ‘adopt’ religion and those who chose to ‘leave’ religion in the WCST, RAT, and AUT may signify that ‘adopting’ a religious ideology is a process that makes use of heightened cognitive persistence while scepticism towards religion is tied to a tendency towards cognitive flexibility. Overall the findings indicate that the act of choosing one’s affiliation is more indicative of one’s cognitive control style than one’s upbringing.

The present findings have multiple theoretical and methodological implications for the study of the psychology of religion. Firstly, from a methodological standpoint, this investigation suggests that it is possible to study religious life and experiences using the methodologies of cognitive psychology, and that assessing how cognitive control styles are linked to strictness of ideology is a fruitful path for psychologists of religion to take. A rich literature on the psychology of religion has demonstrated that nonreligious individuals have a stronger tendency to inhibit intuitively compelling incorrect ideas on the Cognitive Reflections Test (Shenhav, Rand & Greene, 2012; Pennycook et al., 2012; Gervais & Norenzayan, 2012; see meta-analysis: Pennycook et al., 2016; see failures to replicate: Sanchez et al., 2017; Yonker et al., 2016), which is thought to measure an analytical cognitive style. Nonetheless, the Cognitive Reflections Test (Frederick, 2005) only relies on three items consisting of mathematically-based problems and so may confound numeracy ability. It would therefore be valuable for future work to examine the interaction between an analytic and flexible cognitive style in shaping religious beliefs and identities. Interestingly, recent cross-cultural evidence suggests that there is large variability in the relation between analytic thinking and religiosity across different countries (Gervais et al.,

2018), and so it will be worthwhile to investigate whether there is cross-cultural variation in the relationship between cognitive flexibility and religiosity as well.

Importantly, research has begun to focus on the perceptual underpinnings of religiosity, indicating that the hierarchical visual perception, as measured with Navon's (1977) global-local perception task, of atheists differs from that of neo-Calvinists (Colzato et al., 2008; 2010a), Italian Roman Catholics (Colzato et al., 2010a), Orthodox Jews (Colzato et al., 2010a), and Taiwanese Zen Buddhists (Colzato et al., 2010b). This suggests that religious adherence can fundamentally shape visual attention (Hommel & Colzato, 2010). Interestingly for the present study, there is a positive relationship between individual differences in the tendency to visually encode the "bigger picture" of hierarchical visual stimuli and RAT performance (Zmigrod, Zmigrod, & Hommel, 2015), suggesting that individual and group differences in perception may lend themselves to differences in cognitive control style. Consequently, engagement in religious practices appears to shape cognitive processing at multiple levels, including perception and meta-control policies such as flexibility and persistence. This is congruent with the model presented by Hommel and Colzato (2017), which proposes that the meta-control strategies of persistence and flexibility are shaped by genetic and cultural factors as well as transient situational factors.

Secondly, these results may be relevant for behavioural genetics studies looking at the heritability of religiousness (Bouchard et al., 1999, 2004; Beer, Arnold, & Loehlin, 1998; Truett et al., 1992). Individual differences in cognitive flexibility, and specifically the WCST, RAT, and AUT Flexibility, have been linked to dopaminergic systems (Braver, Cole, & Yarkoni, 2010; Barnes et al., 2011; Barnett et al., 2007, Chermahini & Hommel, 2010; Mayseless et al., 2013), and so perhaps future behavioural genetic and epigenetic investigations on the heritability of religiosity should investigate the role of genes implicated in dopamine functioning. In fact, an integrative predictive processing framework for understanding religion has been recently proposed (van Elk & Aleman, 2017), implicating the dopaminergic system in the maintenance of religious and paranormal beliefs (Butler et al., 2010, 2011;

Krummenacher et al., 2010; Schjoedt et al., 2008; Sasaki et al., 2013). Generating a neurobiologically-informed research agenda may therefore sharpen our understanding of how ideological commitment is biologically – and not just socially – transmitted across generations through cognitive control styles.

This investigation looked at three aspects of religious life, and this was not meant to be an exhaustive list of all the facets of religious ideologies and experiences. Consequently, future research will need to elaborate on more features of religious rituals and practice, and examine a wider range of religions than those present in this sample. It will also be valuable to examine the trade-off between cognitive flexibility and persistence to a greater extent in order to identify how these cognitive control modes interact (for an in-depth review, see Hommel & Colzato, 2017). Furthermore, this raises interesting questions – does a ritualistic lifestyle and adopting a firm ideological doctrine shape one’s cognitive persistence, or do individuals with heightened cognitive persistence tend to engage more with religious life? Or perhaps it is an interaction of these factors, and if so, it is valuable to characterise the interaction between cognitive predispositions and environmental influences. Longitudinal data may be the best way to address these questions.

In the *Varieties of Religious Experience*, William James argued that “to the psychologist, the religious propensities of man must be at least as interesting as any other of the facts pertaining to his mental constitution” (1902, p. 2). Here we find that individuals’ religious propensities may in fact be linked to features of their cognitive constitution. The results indicate that affiliation and engagement with religion may be rooted in and have consequences for cognitive control styles. These findings highlight that ideological identity, engagement, and environmental upbringing all interact to shape – and be shaped by – the characteristics of one’s cognition. This underlines the tight parallels between one’s flexibility of thought and adherence to ideologies.



# 4

## Chapter 4

### Ideological Symmetries: Testing the Ideological Extremity Hypothesis in American Political Partisanship





## 4 Ideological Symmetries: Testing the Ideological Extremity Hypothesis in American Political Partisanship

### 4.1 Introduction

In *The True Believer* (1951), the thinker Eric Hoffer wrote about crowds and mass movements, “All movements, however different in doctrine and aspiration, draw their early adherents from the same types of humanity; they all appeal to the same types of mind.” Hoffer tapped into an important idea: there may be a certain “*type of mind*” that is particularly drawn to adopting an ideology or doctrine, almost regardless of its content or ambition. Indeed, scholars and scientists have long sought to identify the psychological underpinnings of rigid ideological adherence, particularly since the atrocities committed in the name of political ideologies at the start of the 20th century.

Many psychologists have theorized that *rigid adherence to a political ideology* may reflect underlying *cognitive rigidity* (Adorno et al., 1950; Rokeach, 1954). Nonetheless, there have been two competing hypotheses regarding the precise relationship between cognitive rigidity and political identity. One hypothesis, the *ideological extremity hypothesis*, has suggested that individuals on the political extremes – of both liberal and conservative ideologies – are more cognitively rigid than moderates (Greenberg & Jonas, 2003). This hypothesis emerges from the notion that extreme political partisanship may be linked to inflexible belief systems that capture the world in black-and-white terms and offer certainty and simplicity (Fernbach, Rogers, Fox, & Sloman, 2013; van Prooijen & Krouwel, 2017). Indirect evidence has illustrated that political extremists on both the political left and right are more dogmatically intolerant (van Prooijen & Krouwel, 2017), more likely to feel superior about their beliefs (Toner, Leary, Asher, & Jongman-Sereno, 2013) and to avoid exposure to each other’s opinions (Frimer, Skitka, & Motyl, 2017) relative to political moderates. Consequently, the *rigidity-of-the-extreme* hypothesis suggests that political extremism is underpinned by

a cognitive rigidity that facilitates the attitudinal rigidity that often characterizes political extremists.

The second hypothesis, the so-called *rigidity-of-the-right hypothesis*, has argued that conservatives perceive the world in a more inflexible, categorical way than liberals (Altemeyer, 1998; Jost, Glaser, Kruglanski, & Sulloway, 2003a). This hypothesis has received empirical support through studies demonstrating a relationship between political conservatism and psychological preferences for traditionalism, familiarity, and certainty, and between political liberalism and acceptance of uncertainty and ambiguity (for reviews: Hibbing, Smith, & Alford, 2014; Jost, 2017; Van Hiel, Onraet, & De Pauw, 2010).

Notably, empirical research on this debate has almost exclusively relied on self-report questionnaires as proxies for cognitive rigidity, as opposed to the use of objective cognitive assessments to quantify cognitive inflexibility directly. Self-report measures of cognitive style tend to suffer from considerable limitations, such as failure in self-assessment of cognitive abilities (Kruger & Dunning, 1999), inclusion of political content in non-political measures and non-political content in political measures (Malka, Lelkes, & Holzer, 2017), and poor psychometric properties (Kirton, 1981). Additionally, a recent meta-analysis has shown that correlations between cognitive style and political attitudes are inflated when relying on self-report questionnaires to quantify cognitive rigidity rather than behavioural assessments (Van Hiel, Onraet, Crowson, & Roets, 2016). Furthermore, most measures of “cognitive and perceptual rigidity” used thus far in political psychology have not corresponded to those used in the cognitive psychology literature. Consequently, there is a need to test these hypotheses using established objective and ideologically-neutral measures of cognitive rigidity.

### 4.1.1 *Rigidity-of-the-Extreme: The Psychology of Extreme Partisanship*

The two hypotheses – the *ideological extremity hypothesis* and the *rigidity-of-the-right hypothesis* – tap into two orthogonal aspects of political identity. As noted by Settle, Dawes, and Fowler (2009), “Partisanship is typically evaluated along two dimensions – the strength of reported partisan attachment and the direction of that attachment” (p. 601). While a rich literature has emerged on the psychology of partisan *direction* (i.e. left versus right political orientation), there has been little empirical investigation of the psychological origins of partisan *intensity*, that is, the strength of a person’s partisan identity and attachment (Van Bavel & Pereira, 2018).

Nonetheless, new findings have demonstrated several ways in which political extremists, on both sides of the political spectrum, differ psychologically from political moderates. Relative to moderates, political extremists tend to experience more negative emotions about politics and to derogate outgroups (van Prooijen, Krouwel, Boiten, & Eendebak, 2015) and view politics in more simplistic terms (Lammers, Koch, Conway, & Brandt, 2017). Political extremists’ tendency to believe in simple political solutions to complex societal challenges also predicts their greater likelihood of believing in conspiracy theories (van Prooijen, Krouwel, & Pollet, 2015). Furthermore, research with cognitive anchoring tasks has suggested that political extremists exhibit greater belief superiority and are more likely to reject external information than moderates (Brandt, Evans, & Crawford, 2015). In the case of the EU refugee crisis, political extremists possessed greater judgmental certainty about their knowledge of the crisis, independently of their actual knowledge, than political moderates (van Prooijen, Krouwel, & Emmer, 2017). This demonstrates that both partisan direction and intensity matter for how individuals evaluate ideological arguments and intergroup conflict.

Recently, Jost (2017) pointed out several key questions currently faced by political psychology, including: (1) *What does political psychology have to say about left-wing rigidity?* and (2) *Are ideological differences only evident in subjective, self-report measures and not behaviourally?* With regards to the question of left-wing rigidity, while

recent evidence has shown that left-wing authoritarianism exists and is predictive of voting behaviour (Conway, Houck, Gornick, & Repke, 2018; Conway & McFarland, 2019), there is a lack of research directly examining the relationship between partisan intensity and cognitive rigidity independently of partisan direction. When the rigidity-of-the-right hypothesis and the ideological extremity hypothesis have been pitted against each other, the psychological variables of interest have consisted of intolerance of ambiguity, need for cognitive closure, dogmatism, and integrative complexity (Jost, Glaser, Kruglanski, & Sulloway, 2003b); none have assessed cognitive rigidity directly and objectively. This is related to the second question posed by Jost (2017) about the contrast between self-report and behavioural methods – perhaps the use of behavioural methodologies has the potential to illuminate ideological differences (and similarities) which are absent or obscured in self-report questionnaires.

#### ***4.1.2 Rigidity-of-the-Right: Evidence and Measurement Problems***

Two recent meta-analyses have evaluated the state of the evidence in favour of the rigidity-of-the-right hypothesis. Jost (2017) identified 16 studies which investigated whether conservatives score more highly on tests of “perceptual or cognitive rigidity” than liberals. Nine out of 16 studies supported the rigidity-of-the-right hypothesis, such that the overall unweighted ( $r=.32$ ) and weighted ( $r=.38$ ) effect sizes were large and significant. Notably, however, out of the nine studies demonstrating a significant effect, six studies used self-report rather than behavioural measures: five studies used a self-report measure of cognitive rigidity (Gough & Sanford, 1952), and one study used a self-report measure of intolerance of trait inconsistency (Steiner & Johnson, 1963). Two studies used unvalidated behavioural measures which do not clearly tap into cognitive flexibility: Kidd & Kidd’s (1972) study asked participants to identify changes between visual objects drawn on cards. However, recognizing changes or discrepancies between visual stimuli does not imply adaptability to change or flexibility of thought, and the author-designed task was not validated or used as a measure of cognitive flexibility in later studies. The second study by Neuringer (1964) used the “Rokeach Map Test” as a test of rigidity, in which

participants were presented with sequential street maps and asked to find the shortest distance between two points on the map. After being presented with seven maps in which the shortest route was identical across maps, participants were shown five maps in which a new shortcut was possible. If participants chose the shortcut on any of the five test maps, they were characterized as "nonrigid". This study's small number of test trials (i.e. five), low threshold for being classified as "nonrigid" (scoring above 0 out of 5), small sample ( $N=15$ ), along with the problematic nature of binary assessments of continuous cognitive constructs, should raise serious doubts regarding the validity of Neuringer's (1964) findings. Consequently, the significant findings from this meta-analysis of "cognitive and perceptual rigidity" were based largely on self-report measures and a couple of problematic behavioural tests.

The second meta-analysis, by Van Hiel and colleagues (2016), identified a larger number of studies in which a measure of rigidity was administered ( $N=46$ ), but separated the studies according to whether rigidity was operationalized with a behavioural task ( $N=31$ ) or a self-report scale ( $N=15$ ). Overall, the findings corroborate Jost's (2017) meta-analysis, as conservatism was significantly related to self-reported rigidity ( $r=.47$ ) and, to a lesser extent, behaviourally-assessed rigidity ( $r=.11$ ). Even in this expanded sample of behavioural studies, there is significant variation in how cognitive rigidity was operationalized: for instance, while Rokeach (1954) utilized a set of perceptual problem solving tasks (i.e. the Einstellung problems; which have received criticisms: Levitt, 1956), Sidanius (1985) used the "Political Prediction Test" in which participants are asked to make judgements within the political domain and cognitive flexibility is extracted as an index from how these judgments are made. Consequently, some behavioural measures of cognitive rigidity possess ideological content and so are not inherently politically-neutral.

These two meta-analyses clearly demonstrate that no behavioural study has been conducted for over 20 years on disentangling the rigidity-of-the-right and ideological extremity hypotheses (since 1997; see Van Hiel et al., 2016), and the publication year for a behavioural study up to 1997 is on average 1959 (range: 1948 to 1997). Moreover, the debate has been plagued by relatively small sample sizes

(mean=65, range=15 to 225; calculated from Van Hiel et al., 2016) and diverse methodologies and conceptualizations of both conservatism and rigidity. The present study therefore sought to rely on established, ideologically-neutral cognitive tasks from the neuropsychological literature and recruit a large sample that would be adequately powered to detect these effects.

## 4.2 Materials and Methods

### 4.2.1 *Participants and Procedure*

We sought to recruit 648 participants via Amazon's Mechanical Turk ([www.mturk.com](http://www.mturk.com)) to achieve greater than 90% power to detect a small effect of Cohen's  $f=.1$  at  $\alpha=.005$  in our primary one-way ANCOVAs of the cognitive variables and three groups of political affiliation and conservatism. We anticipated a small effect due to previous work done by Sidanius (1985) and reviewed by Jost and colleagues (2003), which found an average correlation of .15 between general conservatism and conceptually similar cognitive flexibility constructs. We oversampled by 15% and recruited 750 participants, 7 of which were excluded due to providing incomplete responses, yielding a total sample of 743 participants. Data collection was not continued after data analysis. All participants were American citizens. Participants were redirected from Amazon's Mechanical Turk to an online survey hosted by Qualtrics Survey Software for completion of all the self-reported items and the RAT, and later redirected again to Inquisit 5 by Millisecond Software in order to temporarily download software that allows for accurate measure of performance and reaction times in the WCST. Participants were asked about demographic variables such as age, gender, and educational attainment (ranging from high school graduate, some college but no degree, associate degree (2-year), bachelor's degree (4-year), Master's degree, professional degree (JD, MD), or doctoral degree). The research was conducted with the ethical approval of the institution's Department of Psychology Ethics Committee.

### 4.2.2 *Measures*

#### 4.2.2.1 *Political Identity Measures*

##### **Political Party Affiliation**

To indicate their political party affiliation, participants were asked: "Generally speaking, do you usually think of yourself as a Republican, a Democrat, an Independent, or something else?", with the response options being "Republican", "Democrat", "Independent", "No preference", or the option to indicate another affiliation.

## Political Partisanship

To measure participants' feeling of attachment to their political party, participants were presented with a validated measure of identity fusion, the Dynamic Identity Fusion Index (DIFI; Jimenez et al., 2016), which consists of a continuous pictorial representation that allows participants to move a small circle representing "the self" by clicking and dragging it toward or away from a large circle representing "the group/ideology". The amount of overlap between the two circles has been shown to indicate the extent to which individuals feel their personal identity is fused with a collective identity (e.g. Jimenez et al., 2016; Jong, Whitehouse, Kavanagh, & Lane, 2015; Kapitány, Kavanagh, Buhrmester, Newson, & Whitehouse, 2019; Misch, Fergusson, & Dunham, 2018). It has temporal stability, as well as convergent and discriminant validity (Jimenez et al., 2016). In this study, participants were presented with the DIFI twice; once where the group was the "Republican Party" and another when the group was "Democratic Party". Hence, to compute Republican Party Identity Fusion, the size of the overlapping area between the "Me" circle and the "Republican Party" circle was calculated. The same methodology was applied to the calculation of Democratic Party Identity Fusion.

To calculate political partisanship, we computed each participant's maximum identity fusion to either political party (Democratic/Republican Party), and retrieved the value for the party with which the participant was most fused. To capture the left-right spectrum, if participants' maximum fusion was with the Democratic Party, their fusion score was multiplied by -1, to create a spectrum from -100 to 100. This was taken as an index of participants' political partisanship, weighted by partisan direction.

$$PP_{max} = \begin{cases} -Fusion_D & \text{if } Fusion_D > Fusion_R \\ Fusion_R & \text{otherwise} \end{cases}$$

Where  $Fusion_R$  reflects Republican Party Identity Fusion and  $Fusion_D$  reflects Democratic Party Identity Fusion.



As a robustness check, we also computed the difference in participants' fusion to the two parties:

$$PP_{diff} = Fusion_R - Fusion_D$$

Furthermore, in order to obtain an unweighted measure of political partisanship, for cases when it is necessary to examine participants' fusion with their favoured party regardless of the party's political direction, we collapsed  $PP_{max}$  into:

$$PP_{|max|} = \begin{cases} Fusion_D & \text{if } Fusion_D > Fusion_R \\ Fusion_R & \text{otherwise} \end{cases}$$

Consequently, the  $PP_{|max|}$  scale reflects political party identity fusion between 0 and 100, rather than between -100 and 100 as in  $PP_{max}$ .

### **Political Conservatism**

The 12 Item Social and Economic Conservatism Scale (SECS; Everett, 2013) was administered, which asks participants about how positively or negatively they feel towards 12 social and economic political issues on a scale of 0-100 (with increments of 10). As detailed by Everett (2013), the social issues consisted of abortion, religion, the family unit, traditional marriage, traditional values, patriotism, and military and national security. The economic issues included welfare benefits, limited government, business, gun ownership, and fiscal responsibility. By summing the participant's score in response to social issues and separately in response to economic issues, we could compute a score of issue-specific social conservatism and economic conservatism respectively. The reliability of the SECS was high (Cronbach's alpha for overall scale = .883, social conservatism subscale = .872, economic conservatism subscale = .736).

#### 4.2.2.2 Cognitive Flexibility Tests

##### **Remote Associates Test (RAT)**

The Remote Associates Test (RAT; Mednick, 1962) consisted of 15 compound remote associate problems, in which participants are presented with three cue words (e.g. *cottage, swiss, and cake*), and must generate the compound word solution that connects these three words (e.g. *cheese*). Items of varying difficulty levels were selected from established remote associate problems (Bowden & Jung-Beeman, 2003). Participants were given 20 seconds to respond to each item. RAT performance was computed in terms of the proportion of correct words.

##### **Wisconsin Card Sorting Test (WCST)**

The WCST (Grant & Berg, 1948) was administered with Inquisit 5 by Millisecond Software in standard fashion (Heaton, 1981). Participants are presented with four key cards and a deck of response cards that vary on three dimensions (colour, shape, and number of geometric figures) and are asked to match a fifth card from the sequentially-presented response cards to one of the four key cards. Participants need to identify the correct classification rule (out of three potential rules: matching by colour, shape, or number) according to the feedback they receive after each trial. They are informed that the classification rule may change without warning, and indeed the rule alternates after participants correctly respond to ten consecutive trials, requiring a flexible set shift. The task ends after participants complete six categories (twice for each of the three rules) or after 128 trials. To index participants' performance, the accuracy rate were computed.

##### **Alternative Uses Test (AUT)**

In the AUT (Guilford, 1967), participants are asked to generate as many possible uses for two common household items (brick and newspaper) for 2 min. Participants' responses were recorded and scored along four components by two independent raters in accordance with previous guidelines (Cronbach's  $\alpha = 0.994$ ; Chermahini & Hommel, 2010; Madore, Addis, & Schacter, 2015; Roberts et al., 2017).

*Flexibility* was scored according to the number of distinct categories that participants' responses for a given item could be clustered into (e.g. using a newspaper for making origami and making paper dolls are uses that would fall under the same category of arts and crafts, while using a brick for swatting a fly would fall under a separate category). The total flexibility score comprised the sum from all trials. *Fluency* constituted the total number of appropriate responses. *Elaboration* reflected the amount of detail provided by the participants (for brick, "build" would receive a score of 0; "build a house" would receive a score of 1; and "a weapon to protect family when your house is robbed" would be awarded 2 points for specifying detailed use and context). To score *originality*, each response was compared to the responses from the rest of the participants, such that responses to a given object that were only provided by 5% of the sample received an originality point. The total originality score reflected the sum of original scores per participant across all trials. In accordance with convention, nonsensical uses were excluded prior to coding of responses. To establish inter-rater reliability for appropriate categories, level of detail for the elaboration scoring, and originality, the raters separately scored 25 random participants' responses, and once high inter-rater reliability was established with this set on all AUT measures (Cronbach's  $\alpha > 0.91$  on all measures); the raters independently scored the rest of the participants. Each AUT measure reflects the mean score given by the two independent raters.

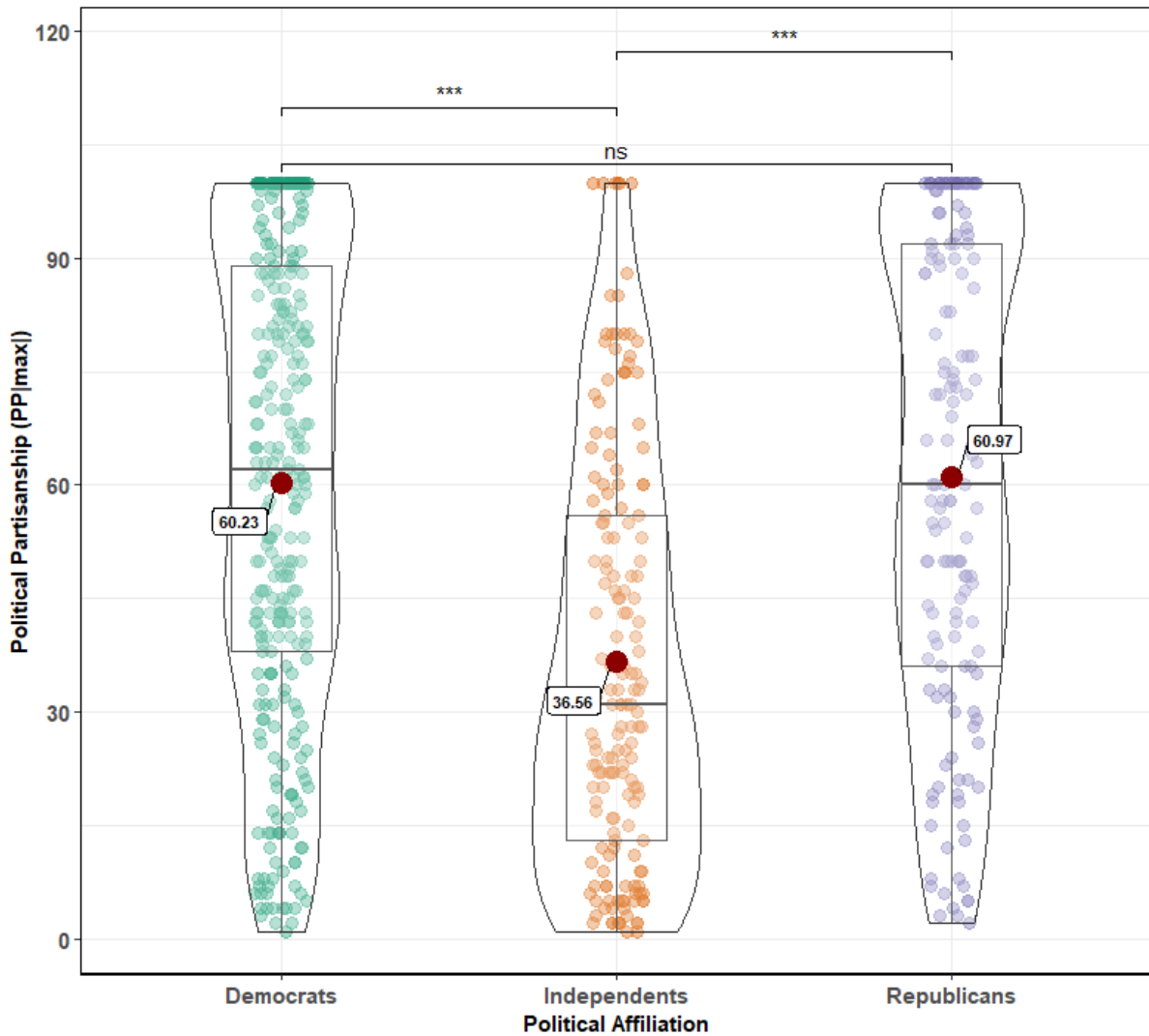
### 4.3 Results

The sample consisted of 743 participants (Age:  $M=36.58$ ,  $SD=13.46$ ; 55.6% female), including 323 self-affiliated Democrats, 161 Republicans, and 203 Independents (56 participants with responded as “Other” and so were excluded for the analyses of political affiliation but were included in all other analyses). We first validated known associations between political affiliation, political partisanship, and conservatism. A MANOVA on participants’ conservatism with respect to their party affiliation demonstrated significant differences between Democrats, Independents, and Republicans in social conservatism,  $F(2,575)=100.265$ ,  $p=4.42\times 10^{-39}$ ,  $\eta_p^2=.259$ , and economic conservatism,  $F(2,575)=148.809$ ,  $p=8.27\times 10^{-53}$ ,  $\eta_p^2=.341$ . After post-hoc Bonferroni correction, across both conservatism measures, Democrats (social conservatism:  $M=342.40$ ,  $SD=134.66$ ; economic conservatism:  $M=228.40$ ,  $SD=66.78$ ) were significantly more liberal than Independents ( $ps<.001$ ; social conservatism:  $M=392.31$ ,  $SD=150.38$ ; economic conservatism:  $M=287.99$ ,  $SD=83.11$ ), and Independents were significantly more liberal than Conservatives ( $ps<.001$ ; social conservatism:  $M=539.87$ ,  $SD=117.77$ ; economic conservatism:  $M=360.79$ ,  $SD=76.29$ ).

Democrats were no more fused to their favoured party – i.e. were no more partisan – than Republicans,  $t(451)=-.237$ ,  $p=.813$  (see Figure 4.1). Participants who identified as Independents were significantly less partisan (to the party with which they felt greater identity fusion) than either Democrats or Republicans,  $F(2,617)=38.582$ ,  $p<.001$ ,  $\eta_p^2=.111$ .

Pearson’s correlations among the cognitive flexibility variables were modest, replicating past research: AUT Flexibility was positively related to RAT ( $r=.20$ ,  $p<.001$ ) and WCST ( $r=.19$ ,  $p<.001$ ), and the correlation between RAT and WCST approached significance ( $r=.10$ ,  $p=.066$ ). There was manifest individual variability in each of the cognitive flexibility measures (RAT:  $M=68.02\%$ ,  $SD=23.85\%$ , range=0 to 100%; WCST:  $M=71.61\%$ ,  $SD=15.31\%$ , range=20.31%; AUT Flexibility:  $M=3.745$ ,  $SD=1.636$ , range=0 to 9).

In terms of the demographic variables, there were no gender differences in performance on any of the cognitive flexibility measures: RAT ( $t(639)=1.346, p=.176$ ), WCST ( $t(396)=-.172, p=.863$ ), and AUT Flexibility ( $t(716)=.416, p=.678$ ). There was a significant gender difference in absolute political partisanship ( $PP_{|max|}$ ) ( $t(636)=2.410, p=.016$ ), with women ( $M=56.09, SD=31.99$ ) exhibiting heightened identity fusion to their favoured political party relative to men ( $M=49.94, SD=31.95$ ). With regards to conservatism, there was no significant gender difference in social conservatism ( $t(622)=.112, p=.911$ ) but there was a significant difference in economic conservatism ( $t(659)=-3.777, p<.001$ ), with men ( $M=293.24, SD=91.80$ ) reporting heightened economic conservatism relative to women ( $M=266.13, SD=90.69$ ). Educational attainment was not significantly related to any of the variables of interest ( $ps>.124$ ). Furthermore, age was positively related to RAT performance ( $r=.136, p=.001$ ), but not WCST ( $r=-.042, p=.403$ ) or AUT Flexibility ( $r=-.021, p=.573$ ). Age was also positively related to social conservatism ( $r=.217, p<.001$ ) and economic conservatism ( $r=.083, p=.034$ ) but not to absolute political partisanship ( $PP_{|max|}, r=-.003, p=.943$ ). However, there was no significant age difference between Republicans ( $M=38.32, SD=12.831$ ), Democrats ( $M=35.69, SD=14.059$ ), and Independents ( $M=36.23, SD=12.913$ ;  $F(2,676)=2.076, p=.126$ ), nor a significant difference in educational attainment ( $F(2,682)=.884, p=.414$ ; Republicans:  $M=2.24, SD=1.373$ ; Democrats:  $M=2.41, SD=1.289$ ; Independents:  $M=2.38, SD=1.261$ ). Consequently, and in accordance with convention, the variables of age, educational attainment, and gender were consistently included as covariates in all statistical analyses unless otherwise specified.



**Figure 4.1.** Political partisanship according to political affiliation. Democrats and Republicans were equally partisan in their identity fusion with their favoured political party ( $PP_{|max|}$ ).  $***p < .001$ , n.s. = not significant.

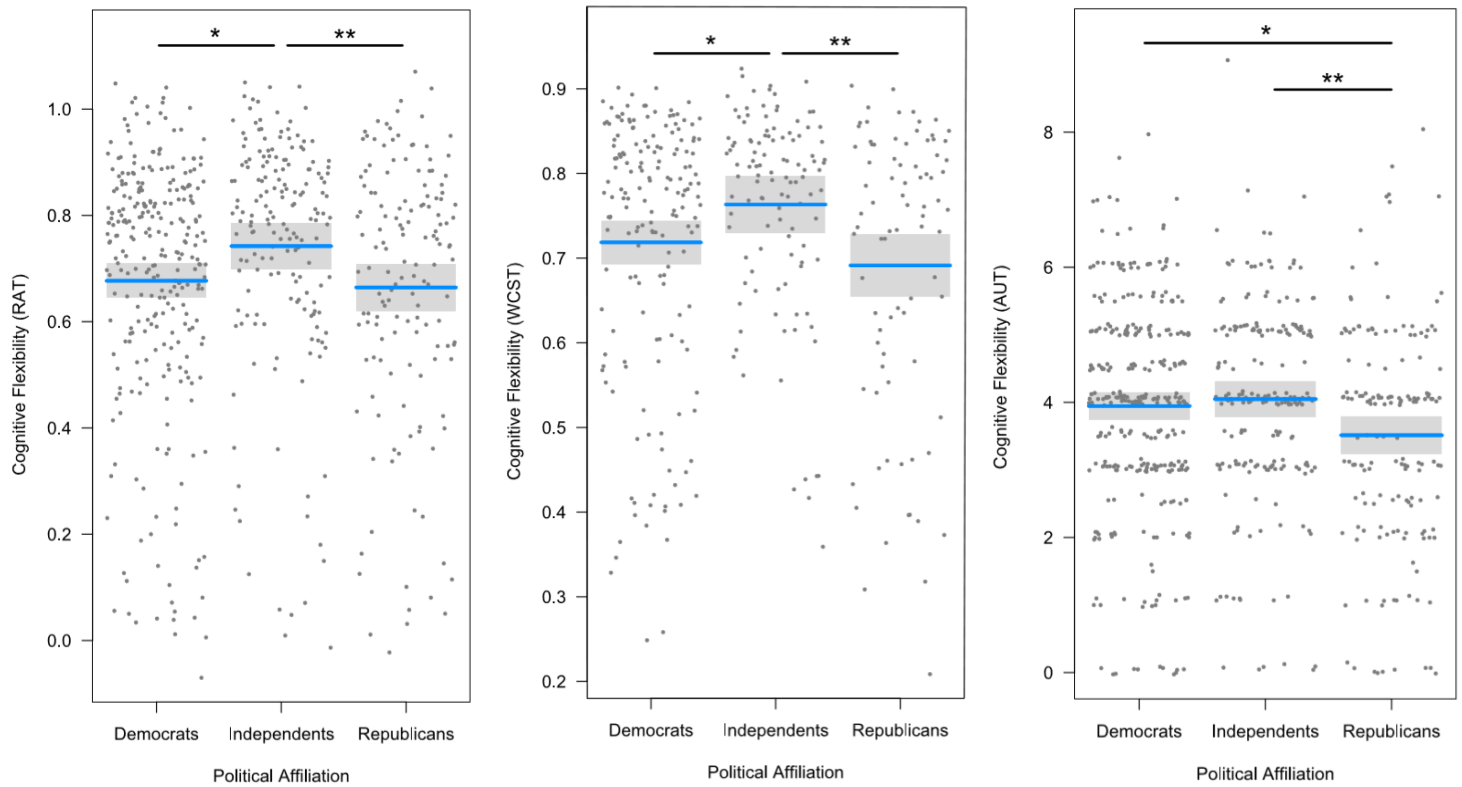
#### 4.3.1 *Political Affiliation and Cognitive Flexibility*

A univariate ANCOVA on RAT performance according to self-reported political affiliation (Democrats, Republicans, versus Independents) was computed, with age, gender, and educational attainment as covariates. This revealed a main effect of political affiliation,  $F(2,595)=5.345$ ,  $p=.005$ ,  $\eta_p^2=.018$ , such that Independents performed significantly better on the RAT ( $M=72.38\%$ ,  $SD=22.26\%$ ) than Democrats ( $M=66.67\%$ ,  $SD=24.19\%$ , Independent-Democrat estimated marginal mean

difference=.065,  $p=.016$ , 95% CI = [.009, .121]) and Republicans ( $M=65.16\%$ ,  $SD=25.38\%$ , Independent-Republican estimated marginal mean difference=.078,  $p=.010$ , 95% CI = [.014, .142]) after post-hoc Bonferroni correction. There was no significant difference between Democrats and Republicans. There were no effects of gender or educational attainment, but there was a significant effect of age,  $F(1,595)=10.131$ ,  $p=.002$ ,  $\eta_p^2=.017$  (Figure 4.2).

Similarly, a univariate ANCOVA on WCST performance with age, gender, and educational attainment as covariates demonstrated a main effect of political affiliation,  $F(2,363)=5.794$ ,  $p=.003$ ,  $\eta_p^2=.031$ , whereby Independents performed significantly better on the WCST ( $M=75.53\%$ ,  $SD=11.83\%$ ) than Democrats ( $M=71.27\%$ ,  $SD=15.67\%$ , Independent-Democrat estimated marginal mean difference=.045,  $p=.047$ , 95% CI = [.000, .089]) and Republicans ( $M=68.28\%$ ,  $SD=17.06\%$ , Independent-Republican estimated marginal mean difference=.072,  $p=.003$ , 95% CI = [.019, .125]) after post-hoc Bonferroni correction. There was no effect of age, gender, or educational attainment. There were no significant differences between Democrats and Republicans (Figure 4.2).

Finally, a univariate ANCOVA on the AUT Flexibility score, with age, gender, and educational attainment as covariates revealed a main effect of political affiliation,  $F(2,664)=5.872$ ,  $p=.003$ ,  $\eta_p^2=.017$  (see Figure 4.2), such that Democrats ( $M=3.903$ ,  $SD=1.533$ ) and Independents ( $M=3.987$ ,  $SD=1.481$ ) performed significantly better than Republicans ( $M=3.456$ ,  $SD=1.637$ ), after post-hoc Bonferroni correction (Republican-Democrat estimated marginal mean difference =  $-.443$ ,  $p=.014$ , 95% CI =  $[-.797, -.068]$ ; Republican-Independent estimated marginal mean difference =  $-.535$ ,  $p=.004$ , 95% CI =  $[-.932, -.137]$ ). There was no difference in AUT Flexibility between Democrats and Independents, and there was no effect of age, gender, or educational attainment.



**Figure 4.2.** Cognitive flexibility according to political affiliation for the three cognitive flexibility tests: Remote Associates Task, Wisconsin Card Sorting Test, and Alternative Uses Test Flexibility score. The shaded areas reflect 95% confidence intervals. Comparisons indicate significant differences after Bonferroni correction, accounting for age, gender, and educational attainment. Data points reflect partial residuals. \* $p < .05$ , \*\* $p < .01$ .

### 4.3.2 Partisanship and Cognitive Flexibility

#### Bayesian Quadratic Regressions

Given the inverted-U-shaped relationship evident in Figure 4.2, we tested for quadratic associations between cognitive flexibility and political partisanship across the political spectrum ( $PP_{max}$ ). For each cognitive flexibility measure, we conducted two regression models: one that assumed a linear relationship and another that assumed a quadratic relationship between cognitive flexibility and political partisanship. We computed Bayes factors for the linear and quadratic regressions to



compare the strength of the evidence for a quadratic (subscript q) over a linear (subscript l) model specification ( $BF_{ql}$ ).

The Bayes factors in this case express the relative likelihood of a quadratic model versus a linear model given the data and certain prior expectations. To calculate Bayes factors using Bayesian regression, we relied on a default Bayesian approach promoted by Wetzels and colleagues (2011), Rouder and Morey (2012) and Liang and colleagues (2008), and computationally specified in the R package *BayesFactor* (Morey, Rouder, & Jamil, 2015). As evident in Table 4.1, across all three measures, there was evidence in favour of quadratic regressions over linear regressions. This was especially pronounced for the RAT and AUT Flexibility. For instance, in the case of the RAT results, the data are more than 2000 times more likely to have occurred under a quadratic model than a linear model, reflecting decisive evidence (for more details on evidence categories see: Wetzels et al., 2011; Jeffreys, 1961) in favour of a quadratic relative to a linear model. Moreover, the coefficients of the quadratic regressions, provided in Table 4.1, demonstrate a significant quadratic effect of political partisanship after adjusting for age, gender, and educational attainment, for all three tests of cognitive flexibility.

**Table 4.1.** Standardized coefficients of quadratic regressions predicting cognitive flexibility.  $BF_{ql}$  indicates the evidence in favour of a quadratic regression over a linear regression model. Interpretation reflects evidence categories for Bayes factors as suggested by Jeffreys (1961) and Wetzels and colleagues (2011). \* $p < .05$ , \*\*\* $p < .001$

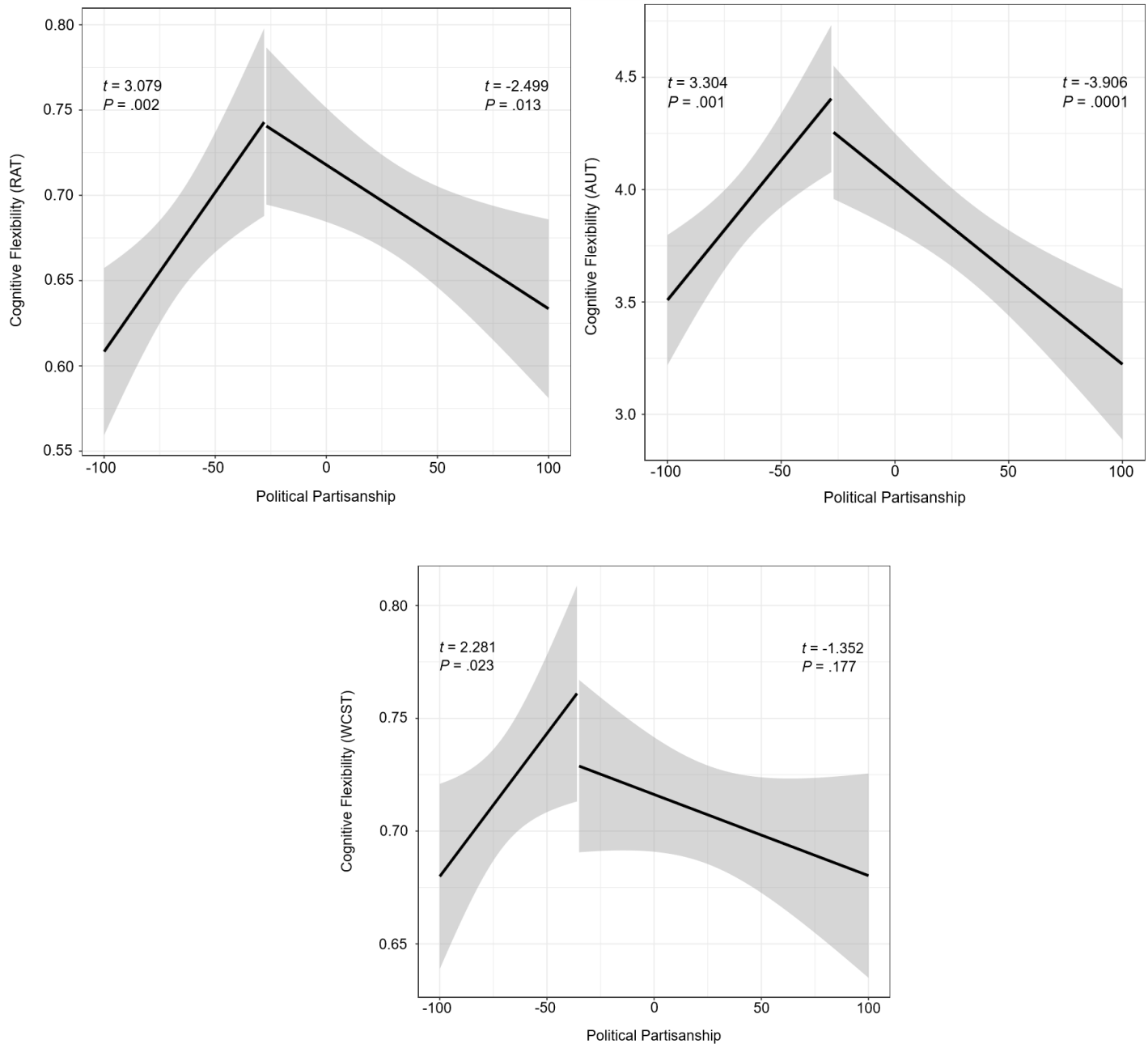
Cognitive Flexibility Test	RAT	WCST	AUT Flexibility
<b>Political Partisanship</b> ( $PP_{max}$ )			
Linear Effect	.00007	-.047	-.091*
Quadratic Effect	-.189***	-.112*	-.186***
Age	.149***	-.051	-.018
Gender	-.076	-.005	.006
Educational Attainment	.060	.022	.022
<b><math>BF_{ql}</math></b>	2117.664	1.782	3712.614
<b>BF Interpretation</b>	<i>Decisive evidence</i>	<i>Anecdotal evidence</i>	<i>Decisive evidence</i>

This was corroborated by a robustness check with the alternative measure of political partisanship,  $PP_{diff}$ . Regressing political partisanship ( $PP_{diff}$ ) on RAT revealed a significant quadratic term ( $\beta = -.125, t = 02.861, p = .004$ ) and greater evidence for a quadratic than a linear association,  $BF_{q1} = 10.329$ . Similarly, there was a quadratic effect when regressing political partisanship ( $PP_{diff}$ ) on AUT Flexibility ( $\beta = -.114, t = -2.731, p = .007$ ), with strong evidence for a quadratic regression model  $BF_{q1} = 7.493$ .

### **Interrupted Regressions**

To validate the existence of inverted U-shaped relationships, we use an interrupted regression model (the two-lines test; Simonsohn, 2018). This method simultaneously estimates two regression lines – one for low  $x$ -values and one for high  $x$ -values. This facilitates the testing of a sign change, that is, whether the average effect of  $x$  on  $y$  is of opposite sign for high versus low values of  $x$ . The two-lines test also identifies a data-driven change point where the two lines split using the “Robin Hood” algorithm, which has been demonstrated to obtain higher statistical power for detecting U-shaped relationships than other algorithmic alternatives (Simonsohn, 2018). An inverted-U-shaped relationship exists if the explanatory variable positively correlates with the outcome variable at low values, and negatively correlates with the outcome variable at high values.

The results are presented in Figure 4.3. The slope between cognitive flexibility and political partisan identity on the left of the political spectrum is positive across all three measures of cognitive flexibility, suggesting that greater party partisanship on the political left is related to reduced cognitive flexibility. Symmetrically, the slope between cognitive flexibility and political partisan identity on the right of the political spectrum is negative, indicating that greater political partisanship on the political right is also related to reduced cognitive flexibility on the RAT and AUT. In the case of the WCST, the results indicated that the relationship between flexibility and partisanship was present on the political left but not political right.

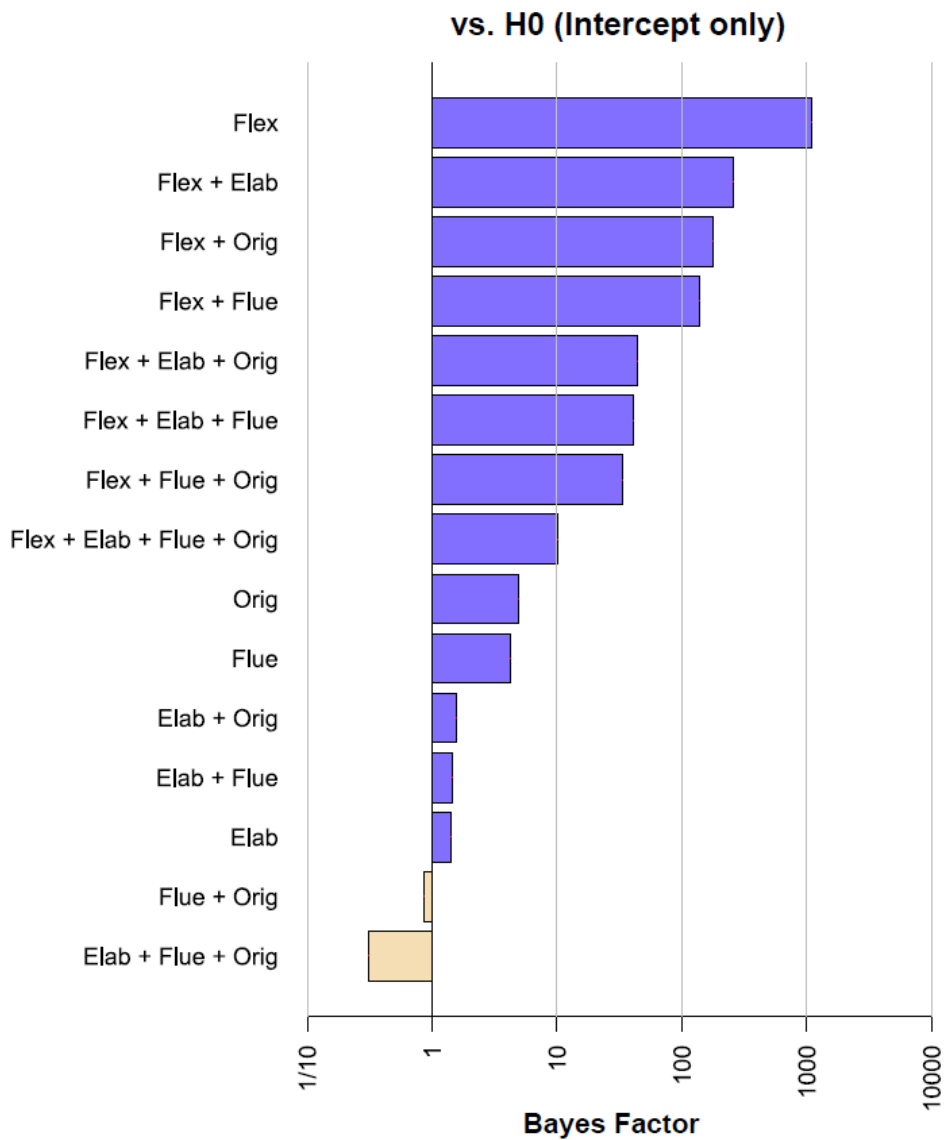


**Figure 4.3.** Interrupted regression results according to cognitive flexibility test. Political partisanship is operationalized according to  $PP_{max}$ , such that partisan intensity is weighted by partisan direction (below 0 reflects left-leaning partisanship and above 0 reflects right-leaning partisanship). The shaded area reflects 95% confidence intervals.

### 4.3.3 *The Specificity of Flexibility*

Additionally, since the AUT assesses multiple aspects of cognition, including flexibility, fluency, elaboration, and originality, we were able to investigate whether cognitive flexibility is specifically implicated in political partisanship relative to other facets of cognition. We conducted a multiple linear regression predicting political partisanship, as operationalized in  $PP_{|max|}$ , with the four AUT measures as predictors. This regression was significant,  $F(4,619)=5.353$ ,  $p=.0003$ , and revealed that cognitive flexibility was the only significant predictor out of the four measurements ( $\beta = -.166$ ,  $t=-3.284$ ,  $p=.001$ ), and elaboration ( $\beta = -.043$ ,  $p=.319$ ), fluency ( $\beta = .054$ ,  $p=.492$ ), and originality ( $\beta = -.056$ ,  $p=.440$ ) were not related to political partisanship.

Bayes factor analysis corroborated these findings (see Figure 4.4). Computing the Bayesian regressions and associated Bayes factors for all possible combinations of AUT sub-measure predictors allows us to balance predictive power and parsimony (by removing redundant predictors). This analysis revealed that the best model is the one that predicts political partisanship only with cognitive flexibility, and no other AUT predictors. The Bayes factor for this model was  $BF_{10}=1100.362$ , indicating that the data are 1100 times more likely under this model than an intercept-only null model ( $H_0$ ). Furthermore, the flexibility-only model (subscript x) was over 100 times more likely than the full model (subscript f) with all AUT sub-measures for these data ( $BF_{xf}=109.551$ ).



**Figure 4.4.** Bayesian model selection results, suggesting that the best model consists only of AUT Flexibility and no other AUT sub-measure. Flex = AUT Flexibility; Elab = AUT Elaboration; Flue = AUT Fluency; Orig = AUT Originality score.

#### 4.3.4 *The Role of Political Conservatism*

The analyses above demonstrate that the relationship between political partisanship and cognitive inflexibility is evident on both the political right and left, thus giving support for the rigidity-of-the-extreme hypothesis. The rigidity-of-the-right hypothesis also makes a prediction regarding political conservatism specifically: that there would be a linear relationship between conservatism and cognitive inflexibility. Correlational and Bayesian analyses offered inconclusive support for this

hypothesis. Social conservatism was significantly correlated with AUT Flexibility ( $r=-.14$ ,  $p=.001$ ,  $BF_{10}=3.09$  (in favour of relationship)) but not with WCST ( $r=-.03$ ,  $p=.567$ ,  $BF_{01}=2.34$  (in favour of null)) or RAT ( $r=-.08$ ,  $p=.055$ , but approached significance,  $BF_{01}=0.91$  (in favour of null)). Economic conservatism was not significantly correlated with AUT Flexibility ( $r=-.07$ ,  $p=.067$ , but approached significance,  $BF_{01}=1.15$  (in favour of null)), WCST ( $r=.04$ ,  $p=.451$ ,  $BF_{01}=2.24$  (in favour of null)), or RAT ( $r=-.03$ ,  $p=.535$ ,  $BF_{01}=2.57$  (in favour of null)).

To ensure that relationships were not attenuated due to the influence of covariates, we conducted a set of multiple hierarchical linear regressions, in which social and economic conservatism were simultaneously included as predictors of cognitive flexibility, while adjusting for the demographic covariates of age, gender, and educational attainment. Social conservatism, economic conservatism, and the demographic variables were therefore included in the first step of the hierarchical linear regression for each cognitive flexibility measure. In the second step, we tested whether the relationship demonstrated above between cognitive inflexibility and political partisanship (unweighted by partisan direction, as operationalized with the collapsed  $PP_{|max|}$  measure) would persist after accounting for any relationships between cognitive inflexibility and political conservatism. Consequently, in the second step of the hierarchical regressions, we included  $PP_{|max|}$  as a predictor of cognitive flexibility.

With respect to predicting flexibility on the RAT, social conservatism was a significant negative predictor ( $\beta =-.170$ ,  $t=-2.842$ ,  $p =.005$ ), while economic conservatism was not ( $\beta =.085$ ,  $t=1.452$ ,  $p =.147$ ) in the first step. In the second step, political partisanship was a significant negative predictor of flexibility ( $\beta =-.207$ ,  $t=-4.665$ ,  $p <.001$ ) as was social conservatism ( $\beta =-.123$ ,  $t=-2.076$ ,  $p =.038$ ). Economic conservatism was still not a significant predictor in the second step ( $\beta =.051$ ,  $t=.884$ ,  $p =.377$ ). Furthermore, predicting flexibility on the AUT demonstrated that economic conservatism was not a significant predictor in the first step ( $\beta =-.024$ ,  $t=-.418$ ,  $p =.676$ ) and social conservatism approached significance ( $\beta =-.108$ ,  $t =-1.892$ ,  $p =.059$ ). In the second step, political partisanship was a significant negative predictor ( $\beta =-.162$ ,  $t =-$

3.762,  $p < .001$ ) while neither economic conservatism ( $\beta = -.048$ ,  $t = -.852$ ,  $p = .395$ ) or social conservatism ( $\beta = -.073$ ,  $t = -1.273$ ,  $p = .204$ ) were statistically significant predictors. WCST was not linearly predicted by either social conservatism ( $\beta = -.086$ ,  $t = -1.096$ ,  $p = .274$ ) or economic conservatism ( $\beta = .090$ ,  $t = 1.178$ ,  $p = .240$ ) in the first step, and was also not predicted by political partisanship in the second step ( $\beta = -.057$ ,  $t = -.996$ ,  $p = .320$ ). This may be due to the asymmetry evident in the interrupted regressions (Fig 3) whereby there is a significant relationship between WCST flexibility and partisanship with regards to the Democratic Party, but not the Republican Party.

Lastly, we also tested whether quadratic relationships between social conservatism and cognitive flexibility would better reflect the data than linear relationships. Bayesian analyses suggested that a linear relationship was either better than a quadratic relationship or there was insufficient data to conclude (WCST:  $BF_{1q} = 3.433$ , AUT:  $BF_{1q} = 1.64$ , RAT:  $BF_{1q} = .501$ ), after controlling for the demographic covariates.

## 4.4 Discussion

The present investigation sought to address the question: *Does mental rigidity reflect one's partisan intensity or political orientation?* The results reveal that strong partisan intensity predicts reduced cognitive flexibility, regardless of the political party's orientation and doctrine. Quadratic regressions revealed that strong partisan intensity, on both the political left and right, was related to reduced flexibility across all three tests of cognitive flexibility (Table 4.1). This was corroborated by Bayes factor analysis, which demonstrated that the relationship between political partisanship across the political spectrum was quadratically – rather than linearly – related to cognitive flexibility (Table 4.1). Bayes factor analysis illustrated that the data were over 2000 times more likely to occur under a quadratic model than a linear regression model for the RAT and AUT (Table 4.1). The inverted U-shaped relationship between flexibility and partisanship was further validated with interrupted regressions (the two-lines test; Simohnson, 2018; Figure 4.3), underscoring that lower cognitive flexibility is evident amongst strong political partisans of both liberal and conservative ideologies. This was further corroborated by the finding that participants who self-described as political Independents exhibited heightened cognitive flexibility relative to Democrats and Republicans on the WCST and RAT (Figure 4.2). Consequently, investigating the roots of partisan intensity uncovers important psychological similarities between adherents to opposing political ideologies.

Analysis of participants' performance on the AUT, which measures multiple aspects of cognition, highlighted that flexibility was specifically implicated as a psychological correlate of partisanship. Other cognitive traits, such as fluency, elaboration, or originality, were not significantly related to partisan intensity. Moreover, when political partisanship was regressed on all possible predictor combinations of the four AUT cognitive measures, the model consisting of cognitive flexibility as the only predictor was the best model (i.e. with the greatest evidential strength). The data were more than 1000 times more likely to occur under a model predicted only by cognitive flexibility than a null hypothesis model (Figure 4.4).



These results have implications for the two dominant hypotheses about the nature of mental flexibility and political ideology. To the best of our knowledge, these findings constitute the first direct objective testing of the *ideological extremity hypothesis* using behavioural assessments of cognitive flexibility rather than self-report questionnaires. The data here support the essential claim of the ideological extremity hypothesis: political extremists were more cognitively rigid than political moderates, across multiple tests of cognitive flexibility (Table 4.1, Figures 4.2 and 4.3). These results suggest that the *rigidity-of-the-right hypothesis* may be incomplete, as it does not account for the presence of the “rigidity-of-the-left”.

When partisan intensity and partisan direction (i.e. conservatism) were simultaneously entered into a linear multiple regression, the relationship between partisan intensity and cognitive inflexibility persisted after controlling for conservatism. This adds to an emerging literature illustrating that political extremists across the political spectrum tend to possess and exhibit similar levels of dogmatism and prejudice (for a review see: Brandt, Reyna, Chambers, Crawford, & Wetherell, 2014), partisan bias and selective exposure to opposing opinions (Ditto et al., 2018; Frimer, Skitka, & Motyl, 2017), moral motives (Frimer, Biesanz, Walker, & MacKinlay, 2013; Frimer, Tell, & Motyl, 2017), simplicity of political categorization (Lammers et al., 2017), and belief in conspiracy theories (Krouwel, Kutiyski, van Prooijen, Martinsson, & Markstedt, 2017). Notably, social conservatism, but not economic conservatism, was a significant predictor of cognitive inflexibility, indicating that there may still be ideological asymmetries that need to be empirically evaluated (Jost, 2017). Note, however, that the regression coefficient of partisan intensity was consistently larger and more statistically significant than that of social conservatism in the multiple linear regression predicting cognitive flexibility (see Results section). Partisan intensity therefore appears to be more predictive of mental flexibility than partisan direction. Economic conservatism was consistently statistically insignificant as a predictor of flexibility. This offers nuanced directions for future research on the rigidity-of-the-right hypothesis - perhaps it is specific to social, as opposed to economic, right-wing conservatism (see also Crowson, 2009; Feldman & Johnson, 2014; Malka & Soto, 2015). Moreover, this gives rise to the question: given the

cognitive similarity between individuals on both political extremes, what factors determine their political orientation? Future studies should seek to replicate and expand these results, as well as explore ways in which the two hypotheses can be combined and empirically negotiated. Jost and colleagues (2003b) proposed a way in which the ideological extremity and rigidity-of-the-right hypotheses may be combined (see Figure 4.2 in their original paper), whereby there would be a U-shaped relationship between mental rigidity and political partisanship, but there would be a weaker relationship between partisan intensity and mental rigidity on the political left relative to the political right. This merits future examination.

The present investigation is relevant to other studies in political psychology which have sought to use indicators of cognitive processing that do not explicitly rely on self-reports. These studies have not directly assessed cognitive flexibility, instead focusing on other cognitive domains, such as confidence and meta-cognition (Brandt et al., 2015; Rollwage, Dolan, & Fleming, 2018), exploratory behaviour (Shook & Fazio, 2009), integrative complexity (Tetlock et al., 1994; Van Hiel & Mervielde, 2003), information evaluation (Ditto et al., 2018), political categorization tendencies (Lammers et al., 2017), and threat sensitivity (Hibbing et al., 2014). Moreover, many of these tasks inherently possess political content (e.g. Ditto et al., 2018; Tetlock et al., 1994; Lammers et al., 2017) and so are not reflections of ideologically-neutral cognitive tendencies. Future research will benefit from examining multiple cognitive domains in tandem in order to evaluate the relative contributions of these individual differences to political ideology and how they may interact (for a review see: van Prooijen & Krouwel, 2019).

The findings also highlight that the common practice of excluding political Independents from political psychology studies may obscure critical relationships and identity processes. We therefore advocate that political Independents are included as a comparison group in the field's studies wherever possible and applicable. Furthermore, it is important to acknowledge the limitations of obtaining representative samples using online participant samples, such as Amazon Mechanical

Turk, and so replicating these effects in nationally representative samples in the US and other political systems will constitute a valuable validation.

In sum, the present findings signify that the way individuals process neutral stimuli and react to the environment can reveal how they process social and political information, and consequently how they form their ideological attitudes and political identities. Moreover, the findings highlight that investigating *processes* such as partisan intensity, attachment, and extremism across opposing ideological orientations may be as scientifically fruitful (if not more so) as studying the *content* of those ideologies. This is in line with Rokeach's (1954) argument that adherents of both extreme left-wing and right-wing ideologies would exhibit tendencies towards rigidity. The cognitively flexible mind may be more likely to formulate socio-political opinions in a way that does not fully conform with the particular constellation of beliefs advocated by a political party. These findings nicely echo Hoffer's early theoretical writings which suggested that "*all movements, however different in doctrine and aspiration... all appeal to the same types of mind*" (Hoffer, 1951).



# 5

## **Chapter 5**

### Deconstructing Dogmatism: The Interaction of Cognitive Flexibility and Intelligence



# 5 Deconstructing Dogmatism: The Interaction of Cognitive Flexibility and Intelligence

## 5.1 Introduction

In an era of polarization, fake news, and the wide spread of misinformation, there is a strong public need for an understanding of how citizens can inoculate themselves against deception and inaccurate information. The capacity to critically evaluate information in nonbiased ways requires *intellectual humility* – the understanding of one’s limitations and biases when making evidence-based decisions. Intellectual humility allows us to avoid psychological tendencies to overlook evidence and confirm prior beliefs. Specifically, intellectual humility has been defined as “recognizing that a particular personal belief may be fallible, accompanied by an appropriate attentiveness to limitations in the evidentiary basis of that belief and to one’s own limitations in obtaining and evaluating relevant information” (Leary et al., 2017).

Over the last decade, a substantial literature has emerged in philosophy, theology, and psychology, seeking to (a) define intellectual humility (Baehr, 2011; Davis et al., 2016; Gregg, Mahadevan, & Sedikides, 2016; Roberts & Wood, 2003; Samuelson et al., 2015; Whitcomb et al., 2015; Wright et al., 2016), (b) develop measurement tools (Hoyle et al., 2016; Krumrei-Mancuso & Rouse, 2016; Leary et al., 2017; McElroy et al., 2014; Meagher et al., 2015), and (c) link intellectual humility to other personality traits such as openness (McElroy et al., 2014; Porter, & Schumann, 2017; Leary et al., 2017), prosociality (Krumrei-Mancuso, 2017), dispositional attachment orientation (Jarvinen & Paulus, 2016), and religiosity and religious tolerance (Hook et al., 2016; Hopkin, Hoyle, & Toner, 2014; Krumrei-Mancuso, 2018; Leary et al., 2017; Rodriguez et al., 2017; Van Tongeren et al., 2016; Zhang et al., 2016). So far, research on the psychological roots of intellectual humility has been primarily the concern of social and developmental psychology.

In theorising about the cognitive mechanisms that might underlie intellectual humility, Samuelson and Church (2015) proposed that the human tendency to rely on heuristics may lead to intellectually arrogant behaviours. Dual-systems accounts of human cognition suggest that thinking and reasoning are characterized by two distinct systems: System 1 processes, which are fast, automatic, associative, and intuitive, and System 2 processes, which are slow, conscious, deliberate, and analytical (Evans, 2003, 2008; Evans, & Stanovich, 2013; Kahneman & Frederick, 2002). The corollary of this dual-systems approach is that in order to reason intelligently and avoid biased thinking, it is necessary to engage System 2 processes which are deliberate and analytical, and to override the automatic biases that are assumed to emerge from System 1 processes (Evans, 2003, 2008). Samuelson and Church (2015) therefore suggest that in order to facilitate intellectual humility, System 2 processes must be engaged and promoted. Interestingly, De keersmaecker and Roets (2017) found that cognitive ability shaped the extent to which individuals adjust their beliefs after learning that their attitudes were based on false information; people with lower levels of cognitive ability adjust their attitudes to a lesser extent than those with higher levels of cognitive ability. Intelligence may therefore be an important cognitive correlate of intellectual humility.

Nevertheless, although deliberate, intelligent, analytical thinking may be important for intellectual humility, it might not be sufficient or necessary. For instance, one can persist in believing one's previous ideas and resist changing them in the face of new evidence even with slow and deliberative thinking. Intellectual humility and the capacity to revise one's ideas and be open to the ideas of others may require more than just analytical thinking or cognitive ability. Specifically, in order to be aware of one's cognitive limitations and evaluate evidence appropriately, considerable mental flexibility is required. While the intellectually arrogant or servile individual disregards new information in favour of past beliefs, the intellectually humble individual is able to be flexible in their thinking, overcome biased reasoning, find creative connections between past ideas and new information, and flexibly adjust



their attitudes based on new evidence. The aim of this study was therefore to evaluate the hypothesis that *the intellectually humble mind is also a flexible mind*.

The hypothesis that cognitive flexibility and openness to novel ideas may be crucial ingredients for intellectual humility has support in the empirical literature. Indeed, Leary and colleagues (2017) found that intellectual humility was positively correlated with self-reported openness to alternative ideas and values, and negatively correlated with dogmatism and intolerance of ambiguity. Stanovich and West (1997) found that participants who scored highly on a self-report measure called “Actively Open-minded Thinking”, which the researchers suggested is an indicator of cognitive flexibility and openness to belief change, were more likely to evaluate arguments based on the argument quality rather than relying on prior beliefs, even when controlling for cognitive ability. The study therefore suggests that a flexible thinking disposition may facilitate intellectual humility independently of cognitive ability. Interestingly, cognitive ability, operationalized with SAT scores and a test of verbal ability, was a unique and independent predictor of argument evaluation performance, signifying intelligence may still play a notable role.

However, there are methodological problems with relying purely on self-report measures of cognitive flexibility. For instance, effect sizes may be inflated in self-report as compared to behavioural measures of cognition, and at times self-report measures yield opposite effects to theoretically-consistent behavioural assessments (e.g. Van Hiel et al., 2016; De Keersmaecker et al., 2017b; Saunders et al., 2017). Furthermore, new tools have been developed to accurately measure intellectual humility and its components directly (Krumrei-Mancuso & Rouse, 2016), and so there is a need to empirically investigate the ways in which flexibility of thought can shape intellectual humility.

The present study sought to disentangle the relationships between cognitive flexibility, cognitive ability (fluid intelligence), and intellectual humility, using classic tasks from experimental psychology. Notably, cognitive flexibility and intelligence have been theoretically and empirically dissociated (e.g. Friedman et al., 2006; Schaie

et al., 1991; Salthouse et al., 1998), and so it is valuable to examine their relative contributions and interactions. This investigation thus addressed three primary hypotheses:

*H1:* Flexible thinking is positively correlated with intellectual humility (building on Stanovich and West's (1997) work).

*H2:* Cognitive ability is positively correlated with intellectual humility (as suggested by Samuelson & Church, 2015 and De keersmaecker & Roets, 2017).

*H3:* There is an interaction between flexibility and intelligence in shaping intellectual humility. If indeed intellectual humility is associated with high cognitive flexibility (in *H1*) and high intelligence (in *H2*), then two plausible, dissociative interaction mechanisms might be at play:

*H3-A:* There is an *additive or multiplicative interaction*, such that the highest intellectual humility would reflect high flexibility and high intelligence, while the lowest intellectual humility would be associated with low flexibility and low intelligence. This hypothesis would predict that individuals who score highly on flexibility, but not intelligence (and vice versa), would have lower intellectual humility than individuals who score highly on both.

*H3-B:* There is a *compensatory interaction*, such that either high flexibility or high intelligence are sufficient for high intellectual humility. Consequently, high flexibility would facilitate intellectual humility particularly for individuals with lower scores on the intelligence test, and vice versa. This hypothesis would predict that individuals who score highly on flexibility, but not intelligence (and vice versa), would have similar levels of intellectual humility as individuals who score highly on both. That is, there is no additive advantage for intellectual humility in scoring highly on both flexibility and intelligence. This would suggest that there are multiple independent psychological pathways to achieving high intellectual humility.

The present study sought to investigate the cognitive correlates of intellectual humility and clarify these mechanisms in order to better understand the psychological underpinnings of intellectual humility and its various facets.

## 5.2 Materials and Methods

### 5.2.1 *Participants*

Power analysis was conducted with the 'pwr' package (Champely et al., 2015) in R (R Core Team, 2018). To estimate the expected effect sizes, we relied on previous work conducted by Leary and colleagues (2017) on relevant relationships between personality and intellectual humility. Specifically, Leary and colleagues (2017) found a correlation between intellectual humility and openness to ideas ( $r=.40$ ) and the Big Five personality factor of openness ( $r=.33$ ), which are conceptually relevant to cognitive flexibility (e.g. DeYoung, Peterson, & Higgins, 2005). Furthermore, they found a correlation between intellectual humility and intrinsically-motivated epistemic curiosity ( $r=.35$ ) and need for cognition ( $r=.34$ ), which are theoretically linked to intelligence – indeed, Fleischhauer and colleagues (2010) found significant correlations between fluid intelligence and need for cognition. Consequently, for the power analyses, we relied on the smallest relevant effect size identified by Leary and colleagues (2017), which was the relationship between the Big Five factor of openness and flexibility, i.e.  $r=.33$ . To obtain a power of approximately 90% at  $\alpha=.05$ , the power analysis revealed a sample size of  $N=92$  would be required. We oversampled by 20% (18 participants), and so recruited a sample of  $N=110$  from Amazon Mechanical Turk (50.8% female; age:  $M=40.75$ ,  $SD=11.40$ ). Two participants were excluded from the analysis since they indicated that their native language was not English, and since the cognitive flexibility tasks were verbal in nature, this was grounds for exclusion from the analysis. In terms of educational attainment, all participants completed high school or an equivalent, and so there were 6 categories of educational attainment: (1) high school diploma only, (2) some college but no degree, (3) 2-year Associate's degree, (4) 4-year Bachelor's degree, (5) Master's degree, or (6) Professional degree (JD, MD). Participants provided their informed consent to participate in the study in accordance with the institution's Department of Psychology Ethics Committee approval.

## 5.2.2 Measures

### *Intellectual Humility – Comprehensive Intellectual Humility Scale (CIHS)*

The CIHS, a 22-item scale developed by Krumrei-Mancuso and Rouse (2016), was used to assess intellectual humility. The CIHS scale measures four distinct factors of intellectual humility: (1) independence of intellect and ego (Cronbach's  $\alpha = .914$ ; e.g. "When someone contradicts my most important beliefs, it feels like a personal attack"), (2) openness to revising one's viewpoint (Cronbach's  $\alpha = .872$ ; e.g. "I am open to revising my important beliefs in the face of new information"), (3) respect for others' viewpoints (Cronbach's  $\alpha = .926$ ; e.g. "I can respect others, even if I disagree with them in important ways"), and (4) lack of intellectual overconfidence (Cronbach's  $\alpha = .822$ ; e.g. "My ideas are usually better than other people's ideas"). The items are rated on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Items were summed for the full scale (Cronbach's  $\alpha = .664$ ) and for each of the subscales (factors). Higher scores indicated greater intellectual humility.

### *Cognitive Flexibility – Alternate Uses Task (AUT)*

In this computerized version of the AUT (Guilford, 1967), two common household items (brick and newspaper) were presented each for 1.5 minutes. Participants were asked to generate as many possible uses for these items. A timed clock was displayed to participants showing them how much time they had left. Flexibility was quantified as the total number of distinct conceptual categories in which the participant's responses belonged, in accordance with convention (e.g. Chermahini & Hommel, 2010; Addis et al., 2016; Madore, Addis, & Schacter, 2015). The responses were rated and calculated by two independent raters.

### *Cognitive Flexibility - Verbal Fluency task (VF)*

In this computerised version of the semantic verbal fluency (Tombaugh, Kozak, & Rees, 1999; Troyer, Moscovitch, & Winocur, 1997), participants are asked to generate words from a given concept (i.e. '*things on wheels*' or '*red things*') for two minutes each. Flexibility was computed as the total number of distinct conceptual categories. The responses were rated and calculated by two independent raters.

*Intelligence - Raven's Standard Progressive Matrices Task (Raven's SPM)*

An abbreviated version of the Raven's SPM (Raven, 1938; Bilker et al., 2012) was used to assess fluid intelligence. The task was composed of nine visual patterns which progressively increased in difficulty. For each matrix pattern, one piece was missing, and participants are asked to select the correct pattern piece from a set of possible solutions.

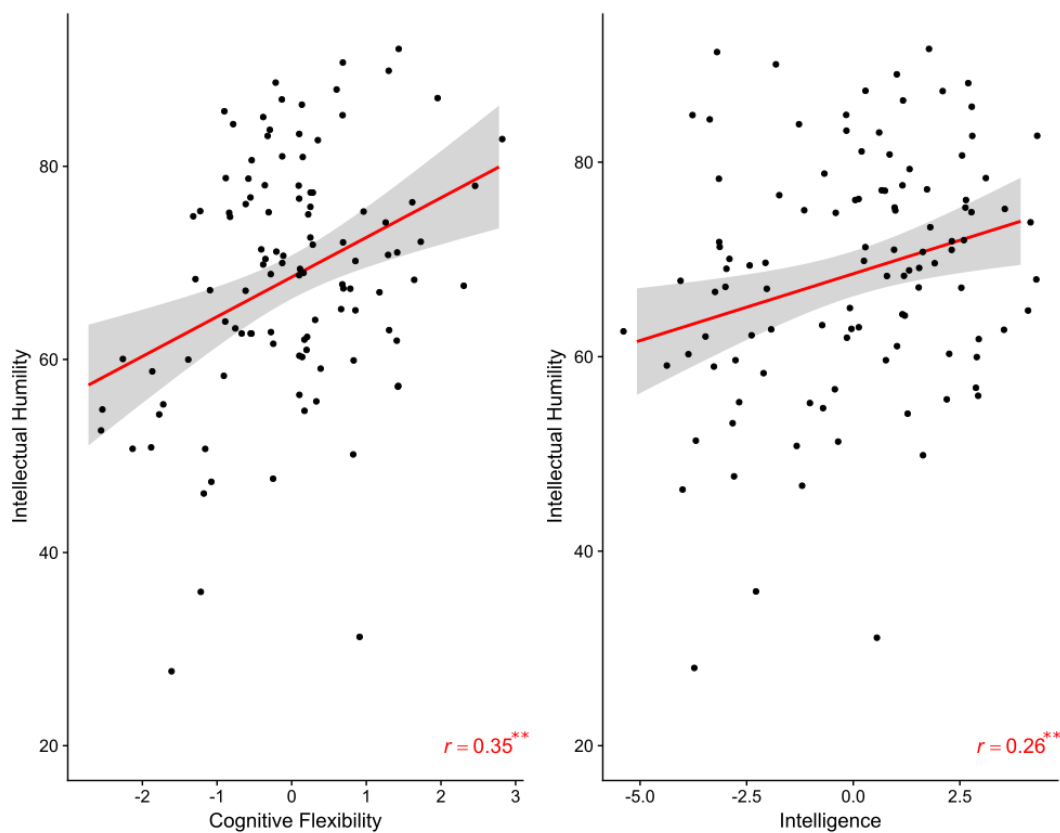
## 5.3 Results

All analyses were conducted in R (R Core Team, 2018) and SPSS (Version 25.0; IBM Corp., 2017), including the R packages *visreg* (Breheny & Burchett, 2017), *jtools* (Long, 2018), and *pwr* (Champely et al., 2015). First, we investigated whether the demographic variables of age, gender, and educational attainment, were related to the psychological variables of interest. Age was not significantly correlated with cognitive flexibility measured with the AUT ( $r=.06, p=.521$ ), cognitive flexibility measured with the VF task ( $r=.011, p=.908$ ), fluid intelligence measured with Raven's SPM ( $r=.037, p=.703$ ), or with the comprehensive intellectual humility score ( $r=.056, p=.567$ ). Furthermore, there were no gender differences in AUT cognitive flexibility,  $t(106)=0.68, p=.501$ , VF cognitive flexibility,  $t(106)=-0.60, p=.552$ , or in intellectual humility,  $t(106)=-1.03, p=.306$ . There was a gender difference in Raven's SPM scores in the current sample,  $t(106)=2.14, p=.035$ , in which males scored higher than females. Educational attainment was significantly correlated with AUT Flexibility ( $r=.23, p=.002$ ) and Raven's SPM ( $r=.31, p=.001$ ), nearly significantly correlated with VF Flexibility ( $r=.18, p=.060$ ), and not correlated with intellectual humility ( $r=.06, p=.552$ ). In all subsequent statistical analyses, age, gender, and educational attainment were included as covariates.

### 5.3.1 *H1: Is intellectual humility positively correlated with cognitive flexibility?*

Correlational analysis revealed that cognitive flexibility measured with the AUT was significantly positively correlated with general intellectual humility (Figure 5.1A). Furthermore, as evident in Figure 5.2, decomposing the Comprehensive Intellectual Humility scale into its constituent factors revealed that this association was primarily driven by the correlations of cognitive flexibility with openness to revising one's viewpoint (Factor 2) and respect for others' viewpoints (Factor 3). Given Gignac and Szodorai's (2016) effect size guidelines for individual differences research, these effect sizes can be considered moderate to large.

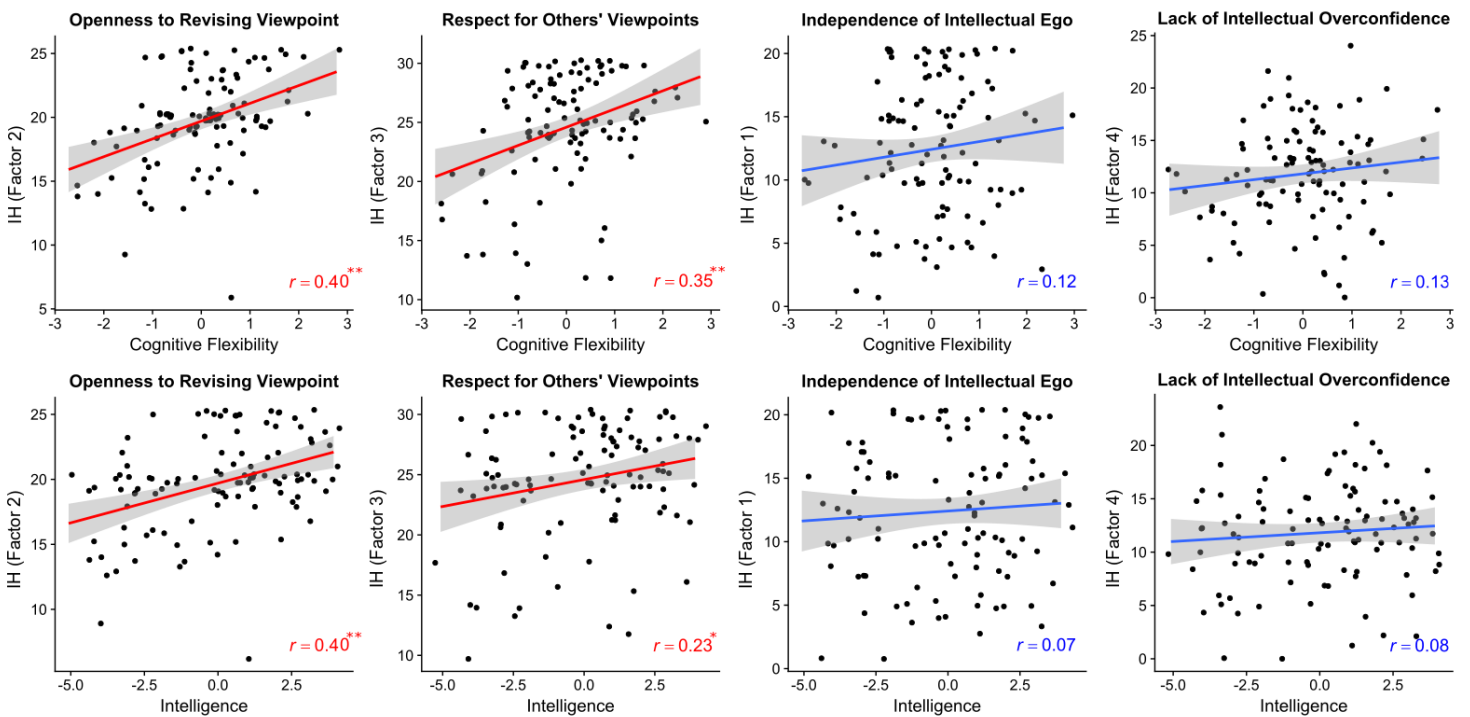
This pattern was corroborated by the correlations of intellectual humility and cognitive flexibility measured with the Verbal Fluency (VF) task. VF Flexibility was positively correlated with the comprehensive intellectual humility scale ( $r=.26$ ,  $p=.007$ ), and specifically with openness to revising one's viewpoint (Factor 2;  $r=.29$ ,  $p=.002$ ) and respect for others' viewpoints (Factor 3;  $r=.24$ ,  $p=.014$ ). There were no significant correlations between VF cognitive flexibility and independence of intellectual ego (Factor 1;  $r=.12$ ,  $p=.207$ ) or lack of intellectual overconfidence ( $r=.09$ ,  $p=.339$ ), paralleling the findings for AUT cognitive flexibility.



**Figure 5.1.** Correlation between Comprehensive Intellectual Humility and (A) cognitive flexibility (centred and measured with the AUT) and (B) intelligence (centred and measured with Raven's SPM). Confidence intervals reflect 95% CI.  $^{**}p < .01$

### 5.3.2 H2: Is intellectual humility positively correlated with intelligence?

As depicted in Figure 5.1B and Figure 5.2 (bottom), intellectual humility was significantly positively correlated with fluid intelligence, such that more intellectually humble individuals tended to score more highly on Raven’s SPM. Similarly to the pattern of results revealed for cognitive flexibility, intelligence was specifically positively correlated to the factors of intellectual humility representing openness to revising one’s viewpoint (Factor 2) and respect for others’ viewpoints (Factor 3; Figure 5.2). The correlation effect sizes were generally smaller for the relationship between intellectual humility and intelligence than for intellectual humility and cognitive flexibility.



**Figure 5.2.** Correlations between specific factors of intellectual humility (IH) and cognitive flexibility (top row) and intelligence (bottom row). Confidence intervals reflect 95% CI. \* $p < .05$ , \*\* $p < .01$ , red=significant correlation, blue=non-significant.



### 5.3.3 *H3: What is the relationship between cognitive flexibility and intelligence in shaping intellectual humility?*

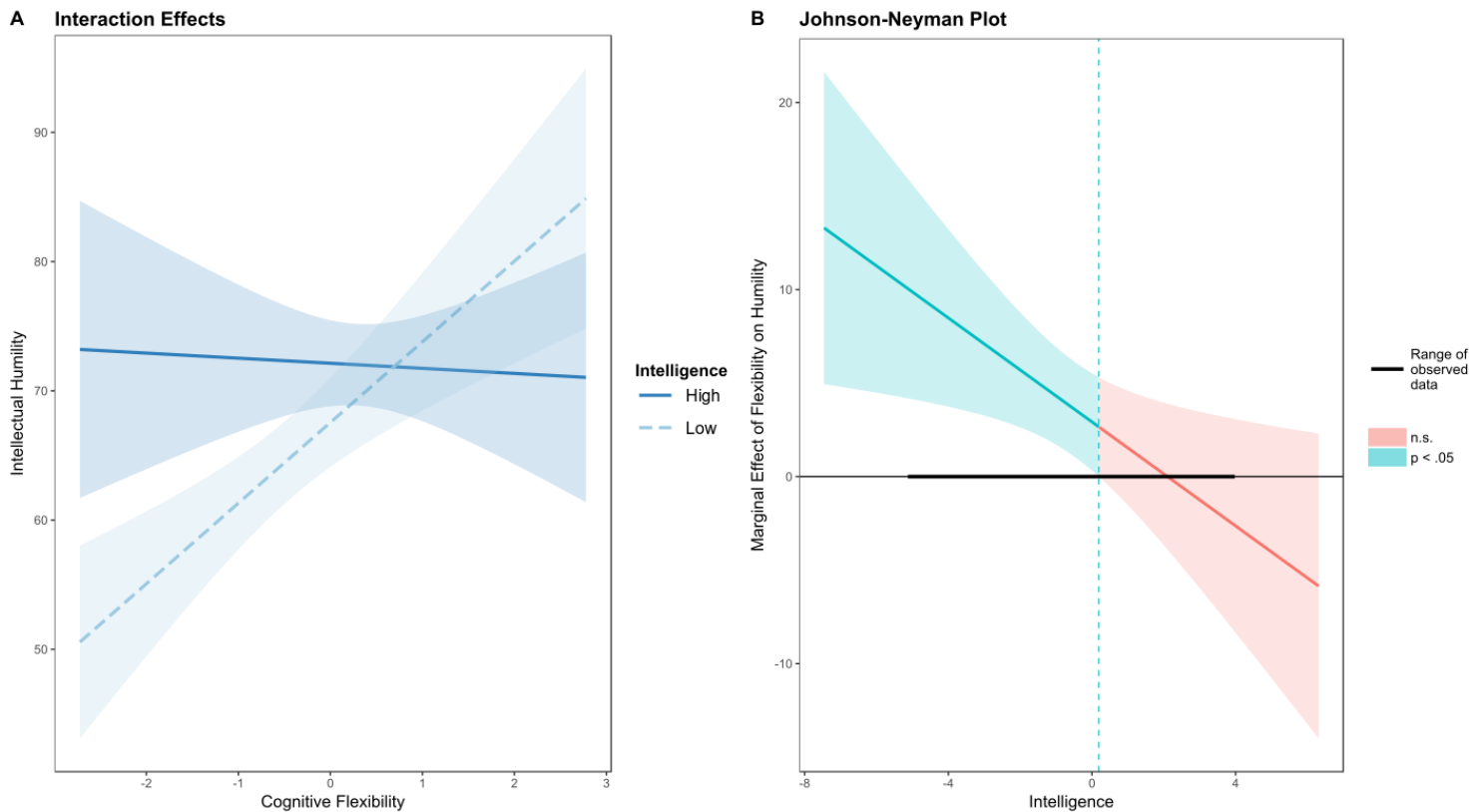
In order to investigate whether, and in what way, cognitive flexibility and intelligence interact to produce heightened intellectual humility, hierarchical linear regression analysis predicting general intellectual humility was conducted (Table 5.1). Note that all independent variables were centred prior to the hierarchical linear regression, as this helps reduce multicollinearity and facilitates testing of simple slopes (Dawson & Richter, 2006). In Step 1, the control variables, including age, gender, and educational attainment, were entered. As shown in Table 5.1, none of these control variables significantly predicted intellectual humility. In Step 2, the centred cognitive flexibility and centred fluid intelligence scores were entered. These independent variables explained a significant proportion of the variance in intellectual humility ( $R^2=.17$ ). As evident in Table 5.1, the coefficients of both cognitive flexibility and intelligence were positive and significant, suggesting that both positively predicted heightened intellectual humility and each was a unique predictor. Next, in Step 3, we entered the interaction term for cognitive flexibility and intelligence. As predicted, the interaction of flexibility and intelligence was significant and accounted for an additional 5.5% of the variance in intellectual humility.

**Table 5.1.** Hierarchical multiple linear regression predicting scores on the Comprehensive Intellectual Humility Scale. Intelligence measured via Raven's scores and Flexibility assessed by the AUT Flexibility score. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

<b>Dependent Variable:</b>					
Comprehensive Intellectual Humility	<i>B</i>	<i>Standard Error (B)</i>	<i>95% CI</i>	$\beta$	<i>p</i>
<b>Step 1</b>					
Age	0.058	.107	[-.154, .271]	.053	.587
Gender	2.512	2.439	[-2.324, 7.349]	.101	.305
Education	0.671	.937	[-1.186, 2.528]	.070	.475
$R^2 = .017$ ; $F(3,104) = .601$ , $p = .616$					
<b>Step 2</b>					
Age	0.011	.100	[-.187, .210]	.010	.910
Gender	3.827	2.308	[-.750, 8.405]	.153	.100
Education	-0.795	.935	[-2.648, 1.059]	-.083	.397
Intelligence	1.069	.535	[.007, 2.130]	.204	.048*
Flexibility	3.596	1.183	[1.250, 5.942]	.304	.003**
$R^2 = .170$ ; $F(5,102) = 4.167$ , $p = .002^{**}$					
<b>Step 3</b>					
Age	0.029	.098	[-.164, .223]	.026	.766
Gender	2.939	2.264	[-1.552, 7.430]	.118	.197
Education	-0.896	.908	[-2.697, .905]	-.094	.326
Intelligence	0.960	.521	[-.073, 1.993]	.183	.068
Flexibility	2.924	1.175	[.594, 5.254]	.247	.014*
Intelligence × Flexibility	-1.390	.515	[-2.412, -.368]	-.248	.008**
$R^2 = .225$ ; $F(6,101) = 4.900$ , $p < .001^{***}$					

Simple slope analyses were conducted to examine the relationship between intellectual humility and flexibility at 1 *SD* above and below mean intelligence, while controlling for age, gender, and educational attainment as covariates (see Figure 5.3A). These analyses revealed that flexibility was positively related to intellectual humility in the context of low intelligence (at -1 *SD*,  $b = 6.24$ ,  $SE = 1.51$ ,  $p < .001$ ) but not high intelligence (at +1 *SD*,  $b = -0.39$ ,  $SE = 1.87$ ,  $p = .834$ ). Reciprocally, simple slope analyses demonstrated that when flexibility is conceptualized as the moderator, intellectual humility was positively related to intelligence in the context of low flexibility (at -1 *SD*,  $b = 2.43$ ,  $SE = .72$ ,  $p < .001$ ), but not for high flexibility (at +1 *SD*,  $b = -0.51$ ,  $SE = .78$ ,  $p = .516$ ).

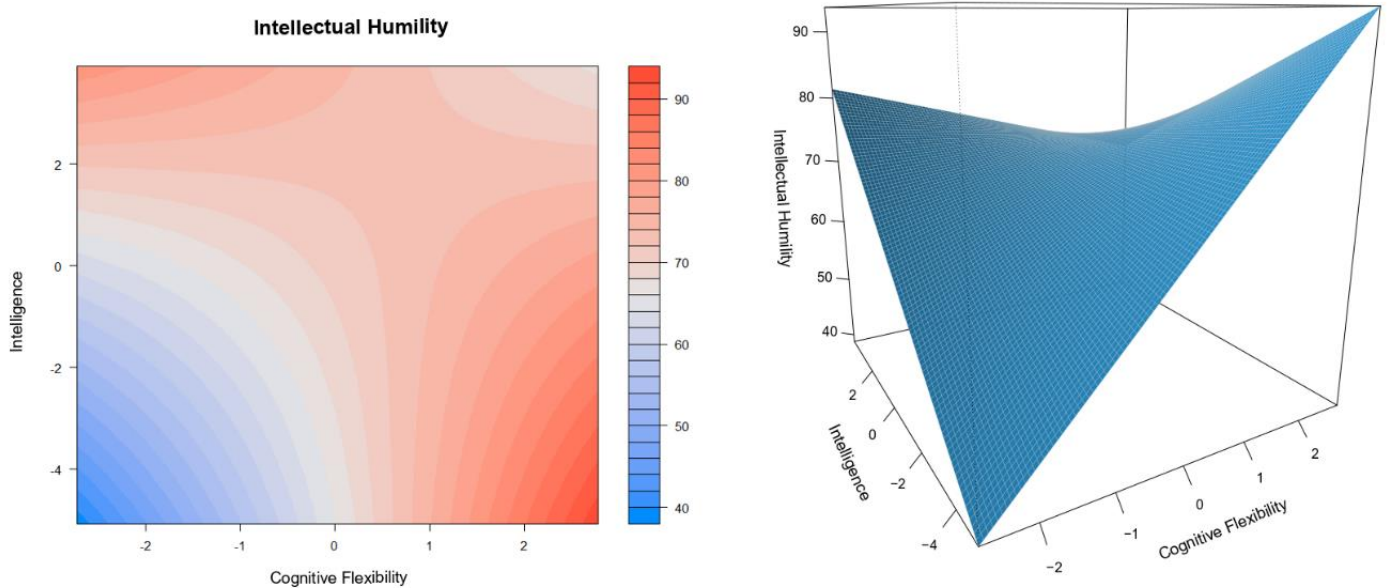
To validate this finding further, the sample was divided into three equal groups (terciles) rather than according to deviation from the mean. The simple slope analysis results were unchanged following this robustness check; cognitive flexibility was positively related to intellectual humility in the context of low intelligence (at -2.67 *SD*,  $b = 6.64$ ,  $SE = 1.61$ ,  $p < .001$ ) but not average intelligence (at +0.5 *SD*,  $b = 2.23$ ,  $SE = 1.25$ ,  $p = .078$ ) and high intelligence (at +2.71 *SD*,  $b = -0.85$ ,  $SE = 2.01$ ,  $p = .674$ ). Reciprocally, intelligence was positively related to intellectual humility in the context of low flexibility (at -0.87 *SD*,  $b = 2.16$ ,  $SE = .66$ ,  $p = .001$ ), but not for average (at +0.28 *SD*,  $b = -0.57$ ,  $SE = .55$ ,  $p = .300$ ) or high flexibility (at +1.23 *SD*,  $b = -0.75$ ,  $SE = .85$ ,  $p = .381$ ).



**Figure 5.3.** (A) Interaction plot between comprehensive intellectual humility, cognitive flexibility, and intelligence (high: +1SD, low: -1SD), controlling for age, gender, and educational attainment. (B) Johnson–Neyman regions of significance and confidence bands for the conditional relation between intellectual humility and cognitive flexibility as a function of intelligence. Solid diagonal line represents the regression coefficient of cognitive flexibility for intellectual humility along the intelligence continuum. The dashed vertical line indicates that at +0.19 SD from the intelligence mean value, the regression coefficient of cognitive flexibility as a predictor of intellectual humility transitions from significance to non-significance. Confidence intervals reflect 95% CI.

This interaction effect is visualized in the filled contour plot and the corresponding 3D perspective plot in Figure 5.4. This depicts that the relationship between intellectual humility and cognitive flexibility varies depending on intelligence, such that intelligence differentiates between low and high intellectual humility at low levels of cognitive flexibility, but not at high levels of cognitive flexibility. Similarly, cognitive flexibility differentiates between low and high intellectual humility at low intelligence scores, but not high intelligence scores. Moreover, Figure 5.4 illustrates that the highest intellectual humility was evident in

participants who scored highly on either intelligence or flexibility, and that scoring highly on both is not related to higher intellectual humility. Figure 5.4 also highlights a slight bias towards higher intellectual humility scores amongst those with high cognitive flexibility (but low intelligence) relative to those with high intelligence (but low flexibility), which is also reflected in the higher regression coefficients in Table 5.1 for cognitive flexibility relative to intelligence.



**Figure 5.4.** Representation of the regression surface predicting intellectual humility as a function of cognitive flexibility and intelligence, while controlling for age, gender, and educational attainment. (A) Filled contour plot. Colour gradient reflects comprehensive intellectual humility score. (B) Perspective plot.

To probe the interaction further, we applied the Johnson-Neyman technique (Johnson & Neyman, 1936; Hayes & Matthes, 2009; Bauer & Curran, 2005), which calculates the range of  $z$  values of the moderator (in this case, intelligence) in which the predictor (i.e. cognitive flexibility) is a significant versus nonsignificant predictor of the outcome (i.e. intellectual humility). This helps to avoid limitations of traditional simple slopes analysis which require selection of potentially arbitrary values of the moderator at which the relationship between the predictor and outcome variable are assessed (e.g.  $\pm 1$  SD from the mean). This technique is increasingly used in the

psychological and cognitive sciences (e.g. Salerno & Peter-Hagene, 2013; Beach et al., 2012; Bushman et al., 2012).

Furthermore, Esarey and Sumner (2017) pointed out that probing interactions in the traditional way can lead to a multiple comparison problem. To address this, we implemented the method proposed by Esarey and Sumner (2017) to control for multiple comparisons; this leads to a more conservative test in which the false discovery rate in the marginal effects plot is controlled.

The findings from the Johnson-Neyman analysis demonstrated that the relationship between intellectual humility and cognitive flexibility was significant when intelligence was less than 0.19 *SD* above the mean, but not significant with higher values of intelligence (Figure 5.3B). This mirrors the finding from the simple slopes interaction analysis (Figure 5.3A), in which the relationship between intellectual humility and cognitive flexibility is significant at low intelligence (-1 *SD*). In accordance with the methodological suggestions of McClelland and colleagues (2017), Spiller and colleagues (2013), and Bauer and Curran (2005), this is revealed graphically in Figure 5.3B. In Figure 5.3B, the transition between significance and non-significance of the conditional effect is indicated by the dashed vertical line, which represents the Johnson-Neyman point at which the 95% confidence band intersects the *x*-axis. In accordance with Esarey & Sumner's (2017) recommendation, the Johnson-Neyman interval was calculated using the false discovery rate adjusted  $t=2.21$ ; note that when not adjusted for multiple comparisons using Esarey & Sumner's (2017) methodology, the Johnson-Neyman point is +0.35 *SD*.

Although we conceptualized intelligence as the moderator of the relationship between intellectual humility and cognitive flexibility, it is important to note that the choice of moderator for analyses is arbitrary – cognitive flexibility could have equally been used as the moderator with paralleling results. We chose to use intelligence as the moderator here because it is largely considered a highly genetically heritable and stable construct, while there is more discussion over the stability and malleability of cognitive flexibility (e.g. Miyake & Friedman, 2012). Nonetheless, as evident in the filled contour plot of Figure 5.4A, there is a symmetry in the interaction effect, such

that the relationship between intellectual humility and intelligence is most pronounced at low levels of cognitive flexibility, and similarly the relationship between intellectual humility and flexibility is evident at low levels of intelligence.

## 5.4 Discussion

Intellectual humility has been identified as a character virtue that enables individuals to recognize their own potential fallibility when forming and revising attitudes and beliefs. The present study examined the relationships between intellectual humility and objectively-assessed cognitive flexibility and fluid intelligence. With regards to our first hypothesis (*H1*), the results indicate that intellectual humility is positively related to heightened cognitive flexibility (Figure 5.1A). Secondly, the findings reveal that intellectual humility is also positively correlated with intelligence (Figure 5.1B), corroborating our second hypothesis (*H2*) and Samuelson and Church's (2015) suggestion that System 2 (i.e. analytical and deliberate) thinking styles are important for engaging in intellectually humble behaviour. These effects were driven by the facets of intellectual humility that correspond to openness to revising one's viewpoints and respect for others' viewpoints (Figure 5.2). Thirdly, the data revealed an interaction between cognitive flexibility and intelligence in predicting intellectual humility (Table 5.1). Specifically, there was evidence of a facilitation effect, such that high cognitive flexibility is particularly valuable for intellectual humility in the context of low intelligence, and reciprocally, high intelligence was beneficial for intellectual humility in the context of low flexibility (Figures 5.3 & 5.4). Interestingly, there was no evidence of an additive or multiplicative effect (contrary to hypothesis *H3-A*), as high flexibility and high intelligence did not produce superior intellectual humility relative to individuals who scored highly on only one of these cognitive traits (corroborating hypothesis *H3-B*; see Figure 5.4). This is suggestive of dual psychological pathways to intellectual humility; either cognitive flexibility or intelligence is sufficient for high intellectual humility, but neither is necessary.

The results demonstrate that cognitive flexibility was more strongly implicated in intellectual humility than intelligence, as manifest by the larger effect sizes (in Table 5.1, Figures 5.1, 5.2, & 5.4). This may signify that the two pathways may have differential efficacy in producing intellectually humble attitudes and behaviours. Furthermore, the study revealed that not all facets of intellectual humility are equally



shaped by cognitive flexibility and intelligence (Figure 5.2). While epistemically-oriented features of intellectual humility, such as openness to alternative ideas (captured by Factor 2) and receptivity to attitude change (Factor 3), were positively correlated with both cognitive traits, the aspects of intellectual humility that are more closely associated with intellectual identity, such as the extent to which one feels threatened when contradicted (Factor 1) and one's conviction that one's own beliefs are superior and infallible (Factor 4), were unrelated to cognitive flexibility and intelligence. The specificity of these relationships suggests that future research will need to examine additional psychological and social factors that shape individuals' tendency to be intellectually overconfident.

These findings raise the question of the malleability of these cognitive traits. Interestingly, Porter and Schumann (2017) found that making salient the belief that people can develop their intelligence (i.e. a *growth mindset of intelligence*, Dweck, 2000), rather than the belief that intelligence is fixed, fosters greater intellectual humility. Porter and Schumann suggested that this may be because a growth mindset of intelligence promotes qualities such as a greater eagerness to learn (Blackwell et al., 2007), diminished defensiveness (Nussbaum & Dweck, 2008), and a more accurate self-assessment of one's knowledge (Ehrlinger et al., 2016). This suggests that intellectual humility may not only be shaped by intelligence, but also by *beliefs about intelligence* as a fixed or malleable trait. With respect to cognitive flexibility, a line of research has developed demonstrating ways in which creative or flexible thinking may in fact be malleable rather than fixed. Flexibility has been shown to be significantly amplified by training with divergent thinking activities such as the AUT in children (Scott et al., 2004, Fleith, Renzulli, & Westberg, 2002), adolescents (Stevenson et al., 2014; Kleibeuker et al., 2017), and adults (Kienitz et al., 2014; Sun et al., 2016), and schizophrenic patients (Nemoto et al., 2009). Even activities such as open-monitoring meditation, in which the individual is asked to freely attend to any incoming thoughts or sensations and be attentionally flexible, has been found to promote flexibility on the AUT (Colzato, Ozturk & Hommel, 2012; Colzato et al., 2017). While the long-term stability of this effect is yet to be fully examined, this implies that

promoting cognitive flexibility is possible and is a worthwhile focal point for future research into fostering intellectual humility.

These findings extend research in three key disciplines: (1) cognitive psychology, (2) social psychology, and (3) interventionist and educational approaches. In the realm of cognitive psychology, recent research has provided corroborating evidence for a positive relationship between intelligence and intellectual humility across the lifespan. Danovitch and colleagues (2017) investigated biopsychological markers of intellectual humility in 6- to 8-year-old children. They found that greater intellectual humility was related to higher intelligence, and this relationship was specific to the epistemic aspect of intellectual humility (i.e. acknowledging the limitations of one's own knowledge) rather than its social component (i.e. representing one's knowledge to other people and being receptive to their ideas). This mirrors the specificity identified in the present study (Figure 5.2). Similarly, developmental work by Mills and Elashi (2014) found that intelligence predicted 6- to 9-year-old children's ability to recognize that a source of information may be worthy of doubt and scepticism. Intelligence may therefore also be linked to early forms of intellectual humility. Additionally, research with adults has illustrated that intellectual humility and receptivity to attitude-change are related to cognitive ability (De keersmaecker & Roets, 2017) and higher discriminability in an old/new recognition memory task (Deffler, Leary, & Hoyle, 2016). Furthermore, Lick, Alter, and Freeman (2017) found that cognitive ability (as measured with Raven's Advanced Progressive Matrices) was related to enhanced updating of social stereotypes in light of new information, supporting the present finding that intelligence may be linked to a willingness to revise one's attitudes based on novel evidence.

These results are also congruent with research in social and political psychology on the psychological correlates of behaviours that may be conceptualized as the opposite of intellectual humility - dogmatism, prejudice, and rigid adherence to ideological doctrines. Intellectual humility has been linked to lower dogmatism and belief superiority (Leary et al., 2017), fewer negative attitudes toward religious outgroups (Van Tongeren et al., 2016), and a willingness to be exposed to opposing

political perspectives (Porter & Schumann, 2017). Frimer, Skitka, and Motyl (2017) have illustrated that liberals and conservatives are similarly motivated to avoid exposure to one another's opinions – a key facet of intellectual humility – suggesting that strong adherence to ideologies is related to a tendency to avoid hearing opposing views. Furthermore, recent empirical work has shown that cognitive ability is negatively related to right-wing ideological attitudes, authoritarianism, and prejudice (e.g. Brandt & Crawford, 2016; De keersmaecker et al., 2017c; Ludeke, Rasmussen, & DeYoung, 2017; Choma & Hanoach, 2017; for meta-analysis: Onraet et al., 2015), and that a cognitive style characterized by rigidity and intolerance of ambiguity is positively related to right-wing attitudes (for meta-analyses: Van Hiel et al., 2016; Jost, 2017). Moreover, a recent set of studies have demonstrated that behaviourally-assessed cognitive inflexibility is related to the extent to which individuals adhere firmly and rigidly to ideologies, in the realm of nationalism (Zmigrod, Rentfrow, & Robbins, 2018; Chapter 2), politics (Zmigrod, Rentfrow, & Robbins, 2019b; Chapter 4), and religion (Zmigrod et al., 2018; Chapter 3). There is therefore converging evidence that intellectual humility and its opposing interpersonal correlate – rigid ideological thinking – are shaped by cognitive ability and cognitive flexibility.

The finding that intellectual humility has multiple distinct psychological underpinnings – an analytical thinking route and a mental flexibility route – provides a fruitful basis on which to expand research into interventions that promote inoculation against misinformation and ideological polarization. Pre-emptively warning individuals about ideologically-motivated efforts to spread misinformation and about the argumentation techniques commonly used in misinformation campaigns has been shown to be effective in neutralizing the effect of misinformation on attitudes (van der Linden et al., 2017; Cook et al., 2017). The present findings are complementary to this line of research on inoculating citizens against fake news for several reasons. Firstly, identifying individual differences in cognition that shape individuals' willingness to revise their attitudes may suggest that individuals with certain psychological traits may be more receptive than others to inoculation interventions. Additionally, perhaps interventions that emphasize certain cognitive

skills (analytical thinking, flexible thinking, etc.) may be more beneficial for individuals with particular psychological dispositions. Future research that combines the interventionist and individual differences perspective will be fruitful in refining our understanding of these processes. Secondly, these studies have focused on examining the effects of conveying information about expert consensus and potential misinformation campaigns in shaping citizens' attitudes (van der Linden et al., 2017) and trying to engage individuals' System 2 analytical processing in evaluating evidence. The current findings suggest that fostering mental flexibility and an attentionally-open information processing style may also be a successful focal point for future interventions.

Several potential limitations of the present study highlight future avenues for research. Firstly, it will be valuable to replicate these findings in lab settings and not just online samples, as well as in different cultural contexts, and with complementary measures of intelligence and cognitive flexibility. Since the *a priori* power analysis we conducted based on relevant effect sizes in the literature recommended a sample size of 92 participants, we computed the power achieved for the multiple regression models. This revealed that the power was 99.29% ( $f^2=.290$ ), suggesting that the analyses were well powered to detect the present effects. Larger samples in future studies will help to corroborate and generalize these findings.

In outlining future directions for the field, Leary and colleagues (2017) identified that "*of particular interest are ways in which people who are high versus low in intellectual humility may differ in how they process information*" (p. 810). The present study addressed this question by illustrating that analytical as well as flexible cognitive processing styles predict heightened intellectual humility. Admitting intellectual fallibility helps facilitate more constructive reactions to disagreements and conflict resolution (Porter & Schumann, 2017). Consequently, identifying and cultivating the cognitive processes shaping intellectual humility may be a key endeavour in building more evidence-based, tolerant, and effective discussions about the contested issues that divide and polarize our societies today.

# 6

## **Chapter 6**

### A Data-Driven Approach to the Psychological Correlates of Ideological Attitudes



# 6 A Data-Driven Approach to the Psychological Correlates of Ideological Attitudes

## 6.1 Introduction

Scholars across the sciences and humanities have long theorized about the psychological origins of citizens' political, nationalistic and religious attitudes (Adorno et al., 1950; Jost, 2017). A rich literature on the psychology of ideology has revealed that individuals' ideological inclinations are related to various psychological traits, such as their personal needs for order and structure (e.g. Jost, 2017; Hannikainen, Miller, & Cushman, 2017), cognitive flexibility (Zmigrod et al., 2018a, 2018b), metacognition and learning styles (Rollwage, Dolan, & Fleming, 2018), and even perceptual reactivity to negative information (Carraro, Castelli, & Macchiaella, 2011; Hibbing et al., 2014; Oxley et al., 2008; Vigil, 2010). While researchers have demonstrated that individuals' ideological orientations are *related* to their psychological dispositions, scientists are yet to answer the question: *to what extent* are psychological factors predictive of ideological attitudes? This is particularly pertinent given the long-held assumption that demographic characteristics and socialization processes are the most powerful predictors of how citizens vote and what they believe (e.g. Campbell et al., 1960; Jennings & Niemi, 1968). Consequently, it is of paramount importance to evaluate the explanatory power of demographic and psychological variables in predicting individuals' ideological orientations.

Here we adopt a data-driven approach to systematically quantify the explanatory power of an individual's demographic background, self-reported personality traits, and behaviourally-assessed cognitive function, towards their ideological attitudes. We examine this in the context of political and nationalistic ideologies, religiosity, and dogmatism. The current investigation therefore espouses a domain-general outlook toward the definition of ideology – focusing on the factors associated with thinking ideologically in *multiple* ideological domains (politics,

nationalism, and religion). This includes dogmatism, which can be conceptualized as a content-free dimension of ideological thought reflecting the certainty with which ideological beliefs are held and the intolerance displayed towards alternative or opposing beliefs (Greenberg & Jonas, 2003; Rokeach, 1948, 1954). Evaluating the psychological similarities and differences between these diverse ideological orientations in concert facilitates a comprehensive overview of the nature of ideological cognition. Furthermore, we seek to map out the psychological landscape of these ideological orientations by investigating which psychological factors amongst those measured by a large battery of cognitive tasks and personality surveys are most predictive of an individual's ideological inclinations. This work aims to bridge methodologies across the cognitive and political sciences, identify key foci for future research, and illustrate the utility of incorporating objective cognitive and personality assessments when predicting ideological convictions.

Empirical research on the psychology of ideology has traditionally been highly theory-driven. This has increased the scope and applicability of political psychology and facilitated the falsifiability of scientific claims by encouraging the development of hypotheses and conceptual frameworks. Nonetheless, a growing concern has emerged amongst researchers that psychologists of politics, nationalism, and religion generate hypotheses and develop study designs that confirm their prior beliefs about the origins of social discord (Duarte et al., 2015; Malka et al., 2018; Washburn & Skitka, 2018; Tetlock, 1994; Jussim et al., 2015). This is exacerbated by the fact that due to limited resources and siloed research disciplines, studies in social psychology frequently focus on one ideological domain (e.g. political conservatism) or one psychological domain (e.g. analytical thinking). While an in-depth focus on a specific domain is essential for theoretical development and replicability, the selection of hypotheses and methodologies can suffer from problems of bias and a lack of conceptual integration across different ideological and psychological domains. It is therefore essential to complement *theory-driven* research with *data-driven* approaches, which can help to overcome these methodological challenges, as well as offer a holistic view of these complex relationships. Perhaps most importantly, data-driven research



can help validate and challenge theory-driven findings and consequently offer directions for future research.

The current study builds on recent work by Eisenberg and colleagues (2018, 2019), in which a large sample of participants (N=522) completed an extensive set of 37 well-established cognitive tasks and 22 self-report surveys focused on self-regulation and personality characteristics. Through factor analysis, Eisenberg and colleagues (2019) constructed data-driven *ontologies* of cognition and personality, identifying a 5-factor structure for the cognitive task variables and a 12-factor structure for the personality survey variables. The power of these ontologies to predict real-world health outcomes was evaluated (Eisenberg et al., 2019). A study of test-retest reliabilities demonstrated that the ontology factor scores possessed high stability over time (4-month mean test-retest reliability across factors of cognitive task ontology:  $M=.82$ ; personality survey ontology:  $M=.86$ ; Enkavi et al., 2019; Eisenberg et al., 2019); this reliability helps to address the challenges of obtaining robust individual differences from cognitive paradigms (Hedge, Powell, & Sumner, 2018; Saunders, Milyavskaya, Etz, Randles, & Inzlicht, 2018). In the present investigation, we recruited 334 participants (49.4% female; age:  $M=37.07$ ,  $SD=8.49$ , range=22-63) from Eisenberg and colleagues' (2018) original sample and administered surveys pertaining to various political, nationalistic, and religious ideological beliefs, as well as dogmatism and its conceptual inverse, intellectual humility. This allowed us to address two key issues: (1) what are the relative contributions of demographics, personality, and cognition, to ideological attitudes? And (2) what psychological factors are most predictive of individuals' ideological orientations?

The 5-factor cognitive ontology was created by decomposing each of the 37 cognitive tasks into multiple dependent measures that reflected psychologically-meaningful variables, such as accuracy scores (e.g. in the case of the working memory Keep Track task), contrasts between different task conditions (e.g. in a task-switching task, including task-switch cost and cue-switch costs), and fitted model parameters used to capture speeded decision-making processes (for details see Eisenberg et al., 2019). Wherever appropriate, performance on two-choice tasks was modelled using

the drift-diffusion model (DDM), which transforms accuracy and reaction time data into interpretable latent variables including *drift rate* (corresponding to average rate of evidence accumulation), *threshold* (corresponding to response caution in terms of speed-accuracy trade-off), and *non-decision time* (corresponding to perceptual stimulus processing and motor execution). This resulted in a total of 129 dependent cognitive measures, which exploratory factor analysis and model selection based on the Bayesian information criterion (BIC) reduced to 5 primary cognitive factors labelled according to their highly loading variables: (1) *Caution* (capturing the DDM threshold parameter), (2) *Perceptual Processing Time* (capturing the DDM non-decision time parameter and stop-signal reaction times associated with response inhibition processes), (3) *Speed of Evidence Accumulation* (capturing the DDM drift rate parameter and other related processes), (4) *Temporal Discounting* (reflecting variables associated with ability to delay immediate gratification for a larger future reward), and (5) *Strategic Information Processing* (reflecting variables associated with working memory capacity, planning, and other higher-order strategies occurring at a longer time-scale than the speeded decisions modelled by the DDM). Detailed information on the nature of the ontology and its constituent elements can be found in papers by Eisenberg and colleagues (2018, 2019) and Enkavi and colleagues (2019).

The same methodology was applied to the 22 self-report personality surveys, resulting in 64 dependent measures that were reduced to 12 factors using oblique exploratory factor analysis. These personality factors were associated with specific measurement scales aimed at assessing various psychological constructs, for example Social Risk-Taking (measured via the Domain-Specific Risk-Taking scale (DOSPERT; Blais & Weber, 2006)) and Impulsivity (captured by the UPPS-P Impulsivity Survey (Lynam et al., 2006), Barratt Impulsiveness Scale (BIS-11; Patton, Stanford, & Barratt, 1995), and I7 Impulsive-Venturesome Survey (Eysenck et al., 1985)). The original selection of surveys and tasks was guided by a focus on measures that capture self-regulation and goal-directed behaviour (Eisenberg et al., 2018). Notably, personality was here broadly construed in terms of self-reported psychological traits measured with validated surveys that aim to tap into stable individual differences, and so personality was not defined in terms of the Big Five model of personality (though the

Big Five traits are included in the creation of the personality ontology). Consequently, while some of the personality and cognitive factors may be theoretically linked to ideological thinking, others should be unrelated (such as Eating Control or Financial Risk-Taking). This offers a check of discriminant validity to ensure that the identified relationships reflect appropriate and relevant psychological correlates of ideological attitudes.

By fractionating individual differences in psychological traits into self-reported personality and behaviourally-assessed cognition, we address the diversity in assessment methods used by social and cognitive psychologists to measure “cognitive style” (Van Hiel et al., 2016). Indeed, recent studies have shown that self-report and behavioural measures of psychological traits may tap into different processes (Eisenberg et al., 2018, 2019; De Keersmaecker et al., 2017), and that the relationship between ideological leanings and cognitive style may be stronger when the latter is measured with self-report questionnaires rather than behavioural tasks (Van Hiel et al., 2016). A clear methodological distinction can therefore reveal patterns of convergence and divergence in the relationships between psychological dispositions and ideological beliefs.

## 6.2 Materials and Methods

### 6.2.1 Participant Recruitment and Demographic Characteristics

Participants were recruited from an existing pool of participants who completed a wide range of cognitive tasks and surveys for Eisenberg and colleagues (2018) on Amazon Mechanical Turk (MTurk). All 522 original participants were contacted via MTurk and invited to participate in an additional study for financial compensation (\$7 for 30-45 minutes), and 334 participants completed the study. With respect to demographic characteristics, participants were asked to indicate age (year of birth), gender (male, female, and prefer not to say or other), educational attainment (less than high school degree, high school graduate, some college but no degree, Associate degree in college (2-year), Bachelor’s degree in college (4-year), Master’s degree, Doctoral degree or professional degree (JD, MD)), and income (<\$10k, \$10-29k, \$30-49k, \$50-99k, \$100-199k, \$200-249k, >\$250k, Prefer not to say).

### 6.2.2. Measures of Ideological Orientations

To comprehensively assess participants’ ideological orientations, each participant completed validated surveys of various ideological inclinations (Table 6.1). A correlogram of these ideological orientations can be seen below in Figure 6.1.

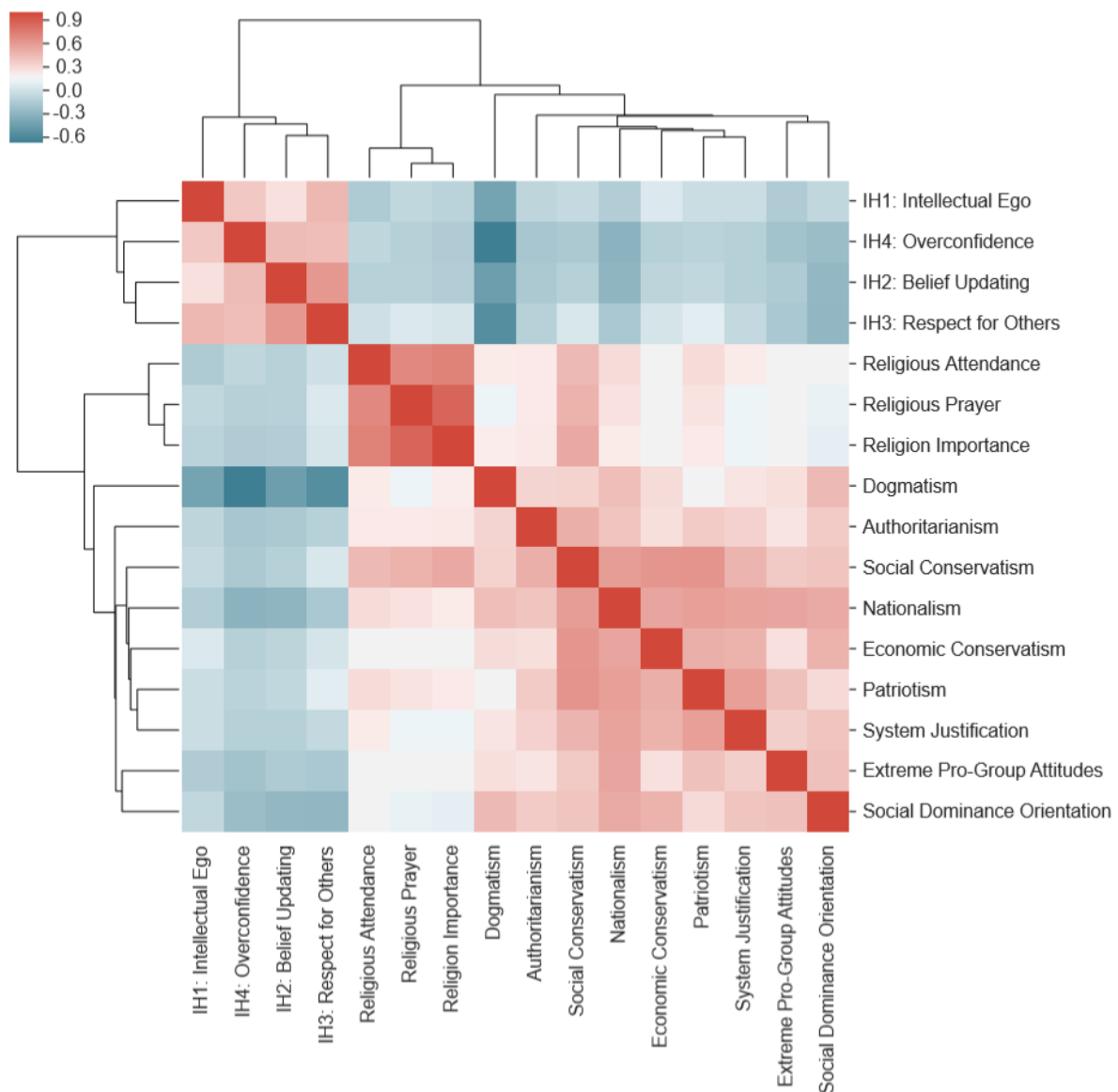
**Table 6.1.** Measures of ideological orientations

<b>Measure</b>	<b>Scale Details</b> (all measures were assessed on a 7-point Likert-scale from “strongly disagree” to “strongly agree”, unless otherwise specified)	<b>Cronbach’s alpha</b>
Social Conservatism (Everett, 2013)	7-item scale. Participants indicate their warmth towards a set of policies. Policies: abortion, traditional marriage, traditional values, family unit, religion, patriotism, military and national security. Scale of 0-100 with intervals of 10.	.728
Economic Conservatism (Everett, 2013)	5-item scale. Participants indicate their warmth towards a set of policies. Policies: limited government, fiscal responsibility, welfare benefits, business, gun ownership. Scale of 0-100 with intervals of 10.	.433

Nationalism (Sidanius et al., 1997)	9-item scale. Participants rate their agreement with statements such as "The United States is no more superior than any other country" (Reverse-coded) and "We should do anything necessary to increase the power of our country, even if it means war".	.894
Patriotism (Federico, Golec, & Dial, 2005)	9-item scale. Participants rate their agreement with statements such as "I find the sight of the American flag very moving" and "I have great love for my country".	.935
Authoritarianism (Hetherington & Weiler, 2009)	4-item scale. Participants indicate whether they believe children ought to be "obedient", "respectful", and "well-mannered" or "curious", "independent", and "self-reliant".	.854
Social Dominance Orientation (Pratto et al., 2013)	4-item scale. Participants rate their agreement with statements such as "we should not push for group equality" and "superior groups should dominate inferior groups". Scale of 0-100 with intervals of 10.	.891
System Justification (Kay & Jost, 2003)	8-item scale. Participants are presented with statements such as "In general, American society is fair" and "American society is set up so that people usually get what they deserve".	.914
Extreme Pro-Group Actions (Swann et al., 2009)	5-item scale. Participants are asked to rate their agreement with statements such as "I would fight someone insulting or making fun of America as a whole" and "I would sacrifice my life if it saved another American's life".	.867
Dogmatism (Shearman & Levine, 2006)	11-item updated version of Altemeyer's (2002) measure of dogmatism.	.834
Intellectual Humility (Krumrei-Mancuso & Rouse, 2016)	Comprehensive Intellectual Humility Scale measuring 4 facets of intellectual humility: Factor 1: Independence of Intellect and Ego Factor 2: Openness to Revising One's Viewpoint Factor 3: Respect for Others' Viewpoints Factor 4: Lack of Intellectual Overconfidence	Factor 1: .920 Factor 2: .865 Factor 3: .881 Factor 4: .837
Importance of Religious (Pew Research Centre)	Participants were asked: "How important is religion in your life?" Response options: not at all important, slightly important, moderately important, very important, extremely important.	-
Religious Prayer Frequency (Pew Research Centre)	Participants were asked: "People practice their religion in different ways. Outside of attending religious services, how often do you pray?" Response options: several times a day, once a day, a few times a week, once a week, a few times a month, seldom, never.	-
Religious Service Attendance Frequency (Pew Research Centre)	Participants were asked: "Aside from weddings and funerals, how often do you attend religious services?" Response options: more than once a week, once a week, once or twice a month, a few times a year, seldom, never.	-

## 6.2.2 Exploratory Factor Analysis

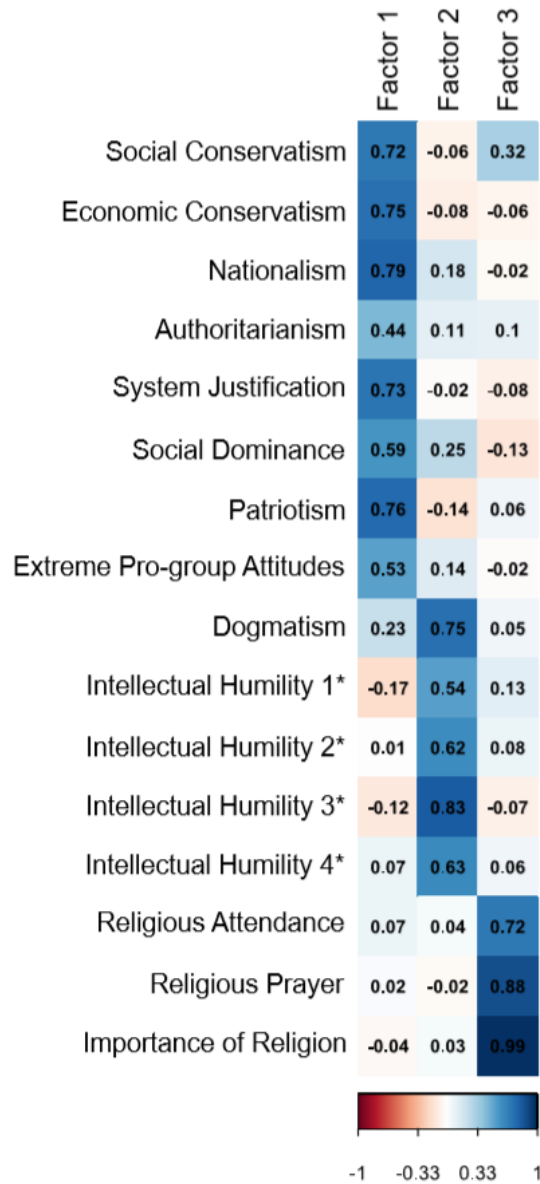
To reduce the dimensionality of the ideological orientations, exploratory factor analysis using oblimin rotation was conducted using the “fa” function from the R package *psych* (Revelle, 2017). Scree plots and parallel analysis both suggested a 3-factor structure was the most appropriate reduction of the data (see Figure 6.2). The correlations between the three ideological factors suggested that they tapped into independent constructs (see Table 6.2).



**Figure 6.1.** Correlogram and cluster analysis of ideological orientations based on Pearson’s correlations. IH = Intellectual Humility. IH1 = Independence of Intellect and Ego; IH2 = Openness to Revising One’s Viewpoint; IH3 = Respect for Others’ Viewpoints; IH4 = Lack of Intellectual Overconfidence. Note that the IH are not reverse-coded and so are in the opposite direction of the other ideological measures.

**Table 2.** Ideology factor correlations

	Factor 1	Factor 2	Factor 3
<b>Factor 1: Political Conservatism</b>	-	.23	.34
<b>Factor 2: Dogmatism</b>	.23	-	.08
<b>Factor 3: Religiosity</b>	.34	.08	-



**Figure 6.2.** Exploratory factor analysis using oblimin rotation on all measured ideological orientations. Scree plots and parallel analysis suggested 3 factors. RMSR = .04. \*orientations reversed to create consistent factors

## 6.3 Results

### 6.3.1 *Quantifying the Role of Psychological Variables in Predicting Ideological Attitudes*

We measured participants' ideological inclinations across multiple domains by administering 16 validated surveys of ideological orientations (an average of 25 months after the initial psychological assessment; the initial assessments did not contain measures directly related to ideological attitudes). These included nationalism, patriotism, social and economic conservatism, system justification, dogmatism, openness to revising one's viewpoints, and engagement with religion (Figure 6.1, Table 6.1). Exploratory factor analysis was conducted to reduce the dimensionality of these ideological orientations, revealing a 3-factor structure corresponding to the following ideological factors: political conservatism, religiosity, and dogmatism. We utilized the factor scores of each participant from this exploratory factor analysis to validate and condense the findings obtained via the 16 ideological orientations (Figure 6.2, Table 6.2). To complement these broad ideological orientations, 16 socio-political policy-specific attitudes were measured in line with the methodology suggested by Everett (2013), in which participants rated their warmth towards issues such as abortion, welfare benefits, fiscal responsibility, same-sex marriage, particular political slogans, and the Paris climate change agreement.

To quantify the role of demographic variables, self-reported personality, and behaviourally-assessed cognition to ideological attitudes, we computed a series of multiple regression analyses on each of the 16 measured ideological orientations, as well as the 3 summative ideological factors. Four linear multiple regression analyses were conducted for each ideological outcome variable, whereby each analysis consisted of regressors associated with one of the following feature matrices: (1) demographic variables (consisting of age, gender, educational attainment, and income), (2) the 5-factor cognitive ontology, (3) the 12-factor personality ontology, and (4) all 17 factor scores and the demographic variables. The  $R^2$  of these linear regression analyses is depicted in Figure 6.3.



As manifest in Figure 6.3, incorporating the psychological variables led to a substantial increase in the variance explained of the ideological orientations relative to regression analyses based on demographics alone. For example, the variance explained for social conservatism was 8.3% by demographic variables alone, and 37.25% when demographic and psychological variables were simultaneously included in the multiple regression. This was consistent across the three summative ideological factors. For the political conservatism factor, demographic variables alone explained 7.43% of the variance, while demographics and the psychological variables together explained 32.5% of the variance (4.4-fold increase). For the religiosity factor and the dogmatism factor, demographics explained 2.90% and 1.53% of the variance respectively, while the combined model explained 23.35% and 23.60% of the variance respectively (corresponding to an 8-fold and 15-fold increase respectively). Consequently, including the cognitive and personality variables led to a considerable increase in the explanatory power of these models.

Overall, the variance explained by demographic variables ranged from 1-12.6%, and the variance explained by the cognitive task variables and personality survey variables ranged between 2-15% and 6-30% respectively. When the demographic and psychological variables were simultaneously included as regressors, the variance explained ranged between 11-37%. Additionally, the personality ontology was consistently more strongly associated with ideological measures than the cognitive ontology (Figure 6.3). This is in line with past research indicating that self-reported measures produce stronger relationships with ideological surveys than behavioural measures of psychological traits (e.g. Van Hiel et al., 2016).

The results also reveal patterns of variability in the contributions of the demographic and psychological variables to different ideological orientations and policy attitudes. While some ideological orientations were well explained by the cognitive ontology, such as social conservatism and patriotism (15.27% and 13.89% of the variance explained by a cognition-only regression model, respectively), other ideological orientations were weakly explained by the cognitive ontology, such as social dominance orientation and system justification (3.04% and 3.10% of the variance

explained by a cognition-only regression model, respectively). Similarly, some ideological orientations were explained well by the personality-only regression models, for example intellectual humility (independence of ego and intellect;  $R^2 = 29.54\%$ ) and social conservatism ( $R^2 = 23.67\%$ ), while other ideologies were explained only moderately better by the personality variables relative to the cognitive variables (e.g.  $R^2$  difference of 5.61% between cognition-only and personality-only models for patriotism). Variability was also evident with regards to policy attitudes: whereas support for abortion was explained very poorly by demographic variables ( $R^2 = 0.33\%$ ) and well by the combined model ( $R^2 = 17.70\%$ ), support for traditional marriage and military and national security were explained equally well by the demographic variables ( $R^2 = 8.28\%$  and  $8.03\%$  respectively) and cognitive ontology ( $R^2 = 10.72\%$  and  $9.59\%$  respectively) and very well by the combined model ( $R^2 = 24.66\%$  and  $25.63\%$  respectively) due to the strong predictive contributions of personality ( $R^2 = 13.75\%$  and  $14.62\%$  respectively). This provides a window into the relative contributions of psychological factors towards different ideologies and attitudes.

To validate the predictive power of these variables, we performed out-of-sample prediction using 10-fold cross validation with L2-regularized linear regression to predict participants' ideological orientations and ideological factor scores using the cognitive and personality ontologies. As evident in Figures 6.3 and 6.S7<sup>9</sup>, the cross-validated findings were consistent with the in-sample linear multiple regression findings (in Figure 6.3), albeit with smaller effect sizes.

To examine the evidential strength for these different models, we computed Bayes Factors, which express the relative likelihood of two regression models given the data and prior expectations. To calculate Bayes factors using Bayesian regression, we relied on a default Bayesian approach promoted by Wetzels and colleagues (2011), Rouder and Morey (2012) and Liang and colleagues (2008), and computationally specified in the R package *BayesFactor* (Morey & Rouder, 2015). We computed Bayes Factors, relative to the null hypothesis ( $BF_{10}$ ), for the regression models consisting of

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<sup>9</sup> All figures with names starting with "6.S" can be found in the Appendix.

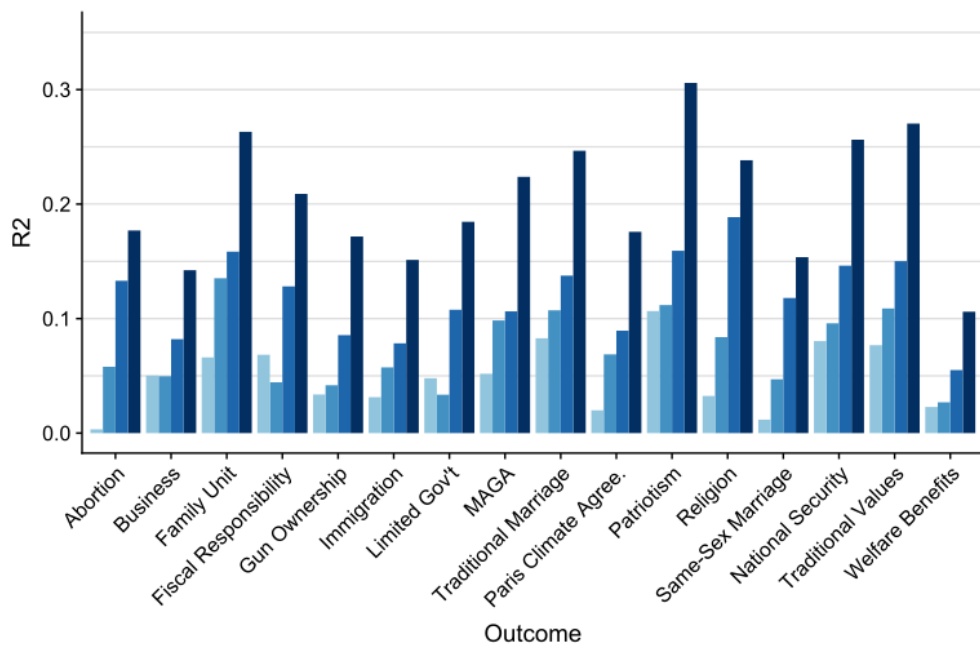
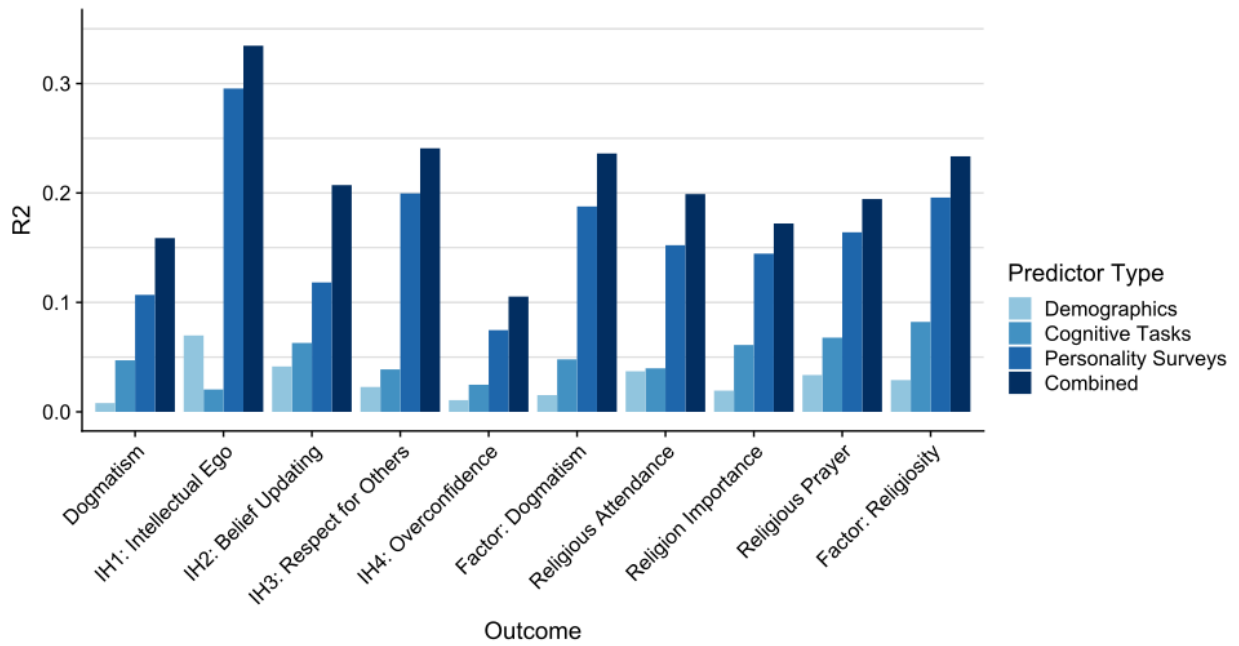
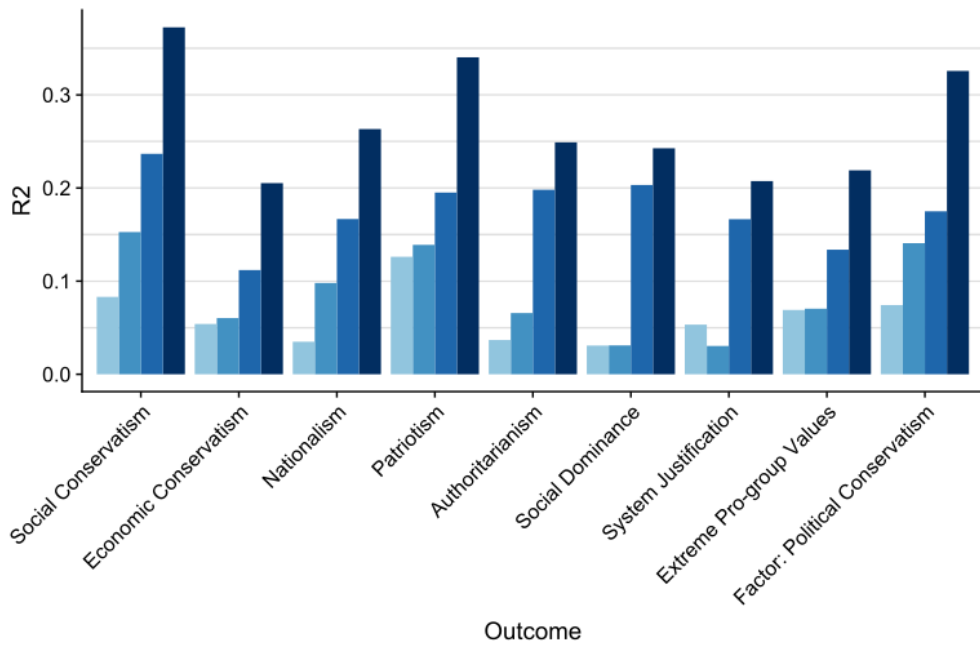
the different predictor types: (1) demographic variables, (2) cognitive ontology, (3) personality ontology, (4) the psychological variables (i.e. the cognitive and personality ontologies combined), and (5) the combined demographic and psychological variables. As evident in Figure 6.4, there was decisive evidence for all models consisting of both cognitive and personality variables. The demographics-only regression model was substantially more likely than a null model given the present data for the political conservatism factor ( $BF_{10}=78.26$ ) but there was moderate evidence in favour of the null model for the dogmatism factor ( $BF_{10}=.01354$ ) and the religiosity factor ( $BF_{10}=.081655$ ; Figure 6.4). This suggests that demographic variables play a key role in explaining ideological attitudes in the realm of politics, but do not explain religiosity or dogmatism in the current dataset.

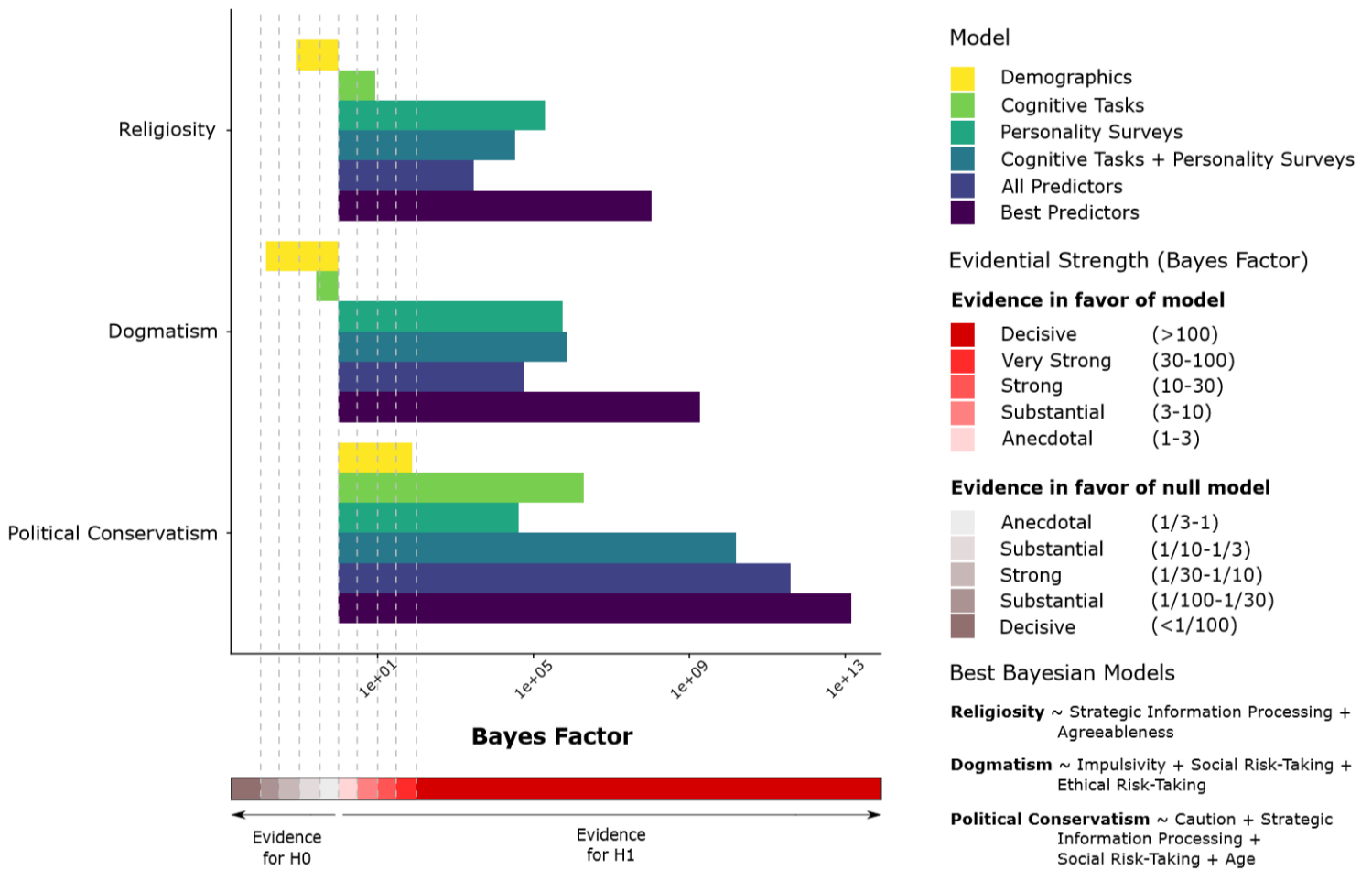
The Bayes factor analysis further illustrates that there is strong evidence in favour of the role of cognition in religiosity, and decisive evidence in favour of its role in political ideology. In contrast, there is decisive evidence in favour of the null hypothesis model relative to a cognition-only model in the case of dogmatism, suggesting that the cognitive ontology is less predictive of dogmatism than an intercept-only model. This is consistent with the  $R^2$  findings evident in Figure 6.3, in which the cognitive variables do not explain a large amount of the variance in the dogmatism factor or its subcomponents. Across all three ideological factors, there is decisive evidence in the current data in favour of the role of personality variables, as well as for models predicted by both personality and cognition, and for a combined model with all the psychological and demographic variables.

Additionally, to evaluate the strength of the evidence for the psychological models (containing cognitive and personality regressors) relative to a model based solely on demographic variables, we also computed Bayes Factors for all the regression models relative to the demographic-only model ( $BF_{dem}$ ; see Figure 6.S1). This corroborated the findings obtained using the  $BF_{10}$ , as the data was extremely more likely to occur under models containing only cognitive and personality variables than a demographics-only model (political conservatism factor:  $BF_{dem} = 1.975 \times 10^8$ ; dogmatism factor:  $BF_{dem} = 5.248 \times 10^7$ ; religiosity factor:  $BF_{dem} = 3.345 \times 10^5$ ).

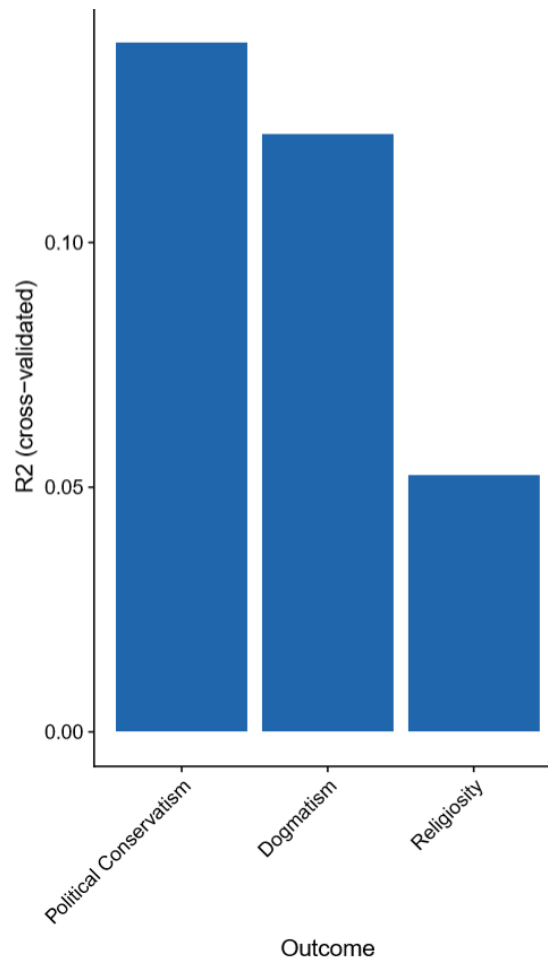
**Figure 6.3.** Association of ideological orientations and policies with demographic variables, cognitive task variables, personality survey variables, and all variables combined. Linear regression  $R^2$  are shown according to predictor type. The outcome variables are arranged according to the three ideological factors derived using exploratory factor analysis: political conservatism (top panel), dogmatism (middle panel), and religiosity (middle panel). Regression on policy-specific attitudes is depicted in the bottom panel. IH = Intellectual Humility. IH1 = Independence of Intellect and Ego; IH2 = Openness to Revising One's Viewpoint; IH3 = Respect for Others' Viewpoints; IH4 = Lack of Intellectual Overconfidence.

[SEE FIGURE ON NEXT PAGE]





**Figure 6.4.** Bayes factors for the three ideological factors for six regression models according to the model type, relative to intercept-only null hypothesis models. The “best” models in terms of Bayes factors are shown. Evidential strength guidelines follow the classification scheme offered by Jeffreys (1961) and advocated by Wetzels and colleagues (2011). For clarity, x-axis is presented on a logarithmic scale.



**Figure 6.5.** Cross-validated predictive accuracy for the three ideological factors using the psychological variables (cognitive and personality variables). All ideological factors are significantly predicted by the cross-validation.

### 6.3.2 *Psychological Signature of Ideological Attitudes*

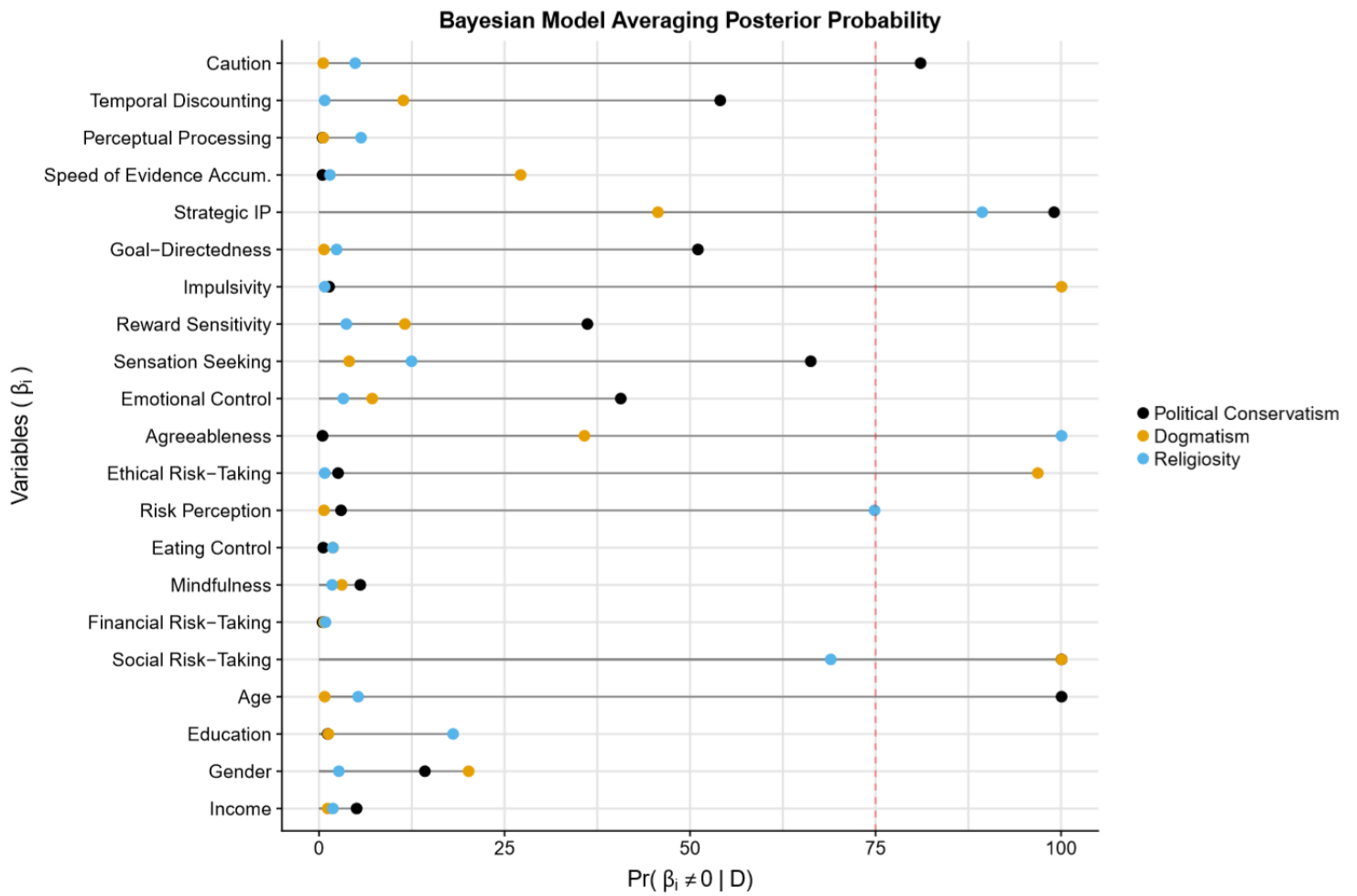
In order to understand the cognitive and personality bases of these ideological orientations, we used the standardized beta coefficients of the linear regression models to generate a “cognitive signature” and “personality signature” of each ideological orientation. Figure 6.7 depicts the standardized estimates of the combined cognitive and personality ontology scores for each of the three summative ideological factors, while controlling for demographic variables (see Figures 6.S3-S6 for the psychological signatures of all the ideological orientations).

The results reveal both diversity and specificity in the psychological correlates of political conservatism, dogmatism, and religiosity. The political conservatism factor, which reflects tendencies towards political conservatism and nationalism, was significantly associated with greater caution and temporal discounting and reduced strategic information processing in the cognitive domain, and by greater goal-directedness, impulsivity, and reward sensitivity, and reduced social risk-taking in the personality domain. As an illustration, Figure 6.8 demonstrates the cognitive correlates of all the ideological orientations captured by the political conservatism factor, revealing that the conservative-leaning political ideologies were consistently related to greater caution and reduced strategic information processing, with some variability in the role of temporal discounting, perceptual processing time, and speed of evidence accumulation. The dogmatism factor was significantly associated with reduced speed of evidence accumulation in the cognitive domain and by reduced social risk-taking and agreeableness as well as heightened impulsivity and ethical risk-taking in the personality domain. Similarly to political conservatism, the religiosity factor was also significantly associated with greater caution, and reduced strategic information processing and social risk-taking, but in contrast to dogmatism and political conservatism, religiosity was associated with greater agreeableness and risk perception.

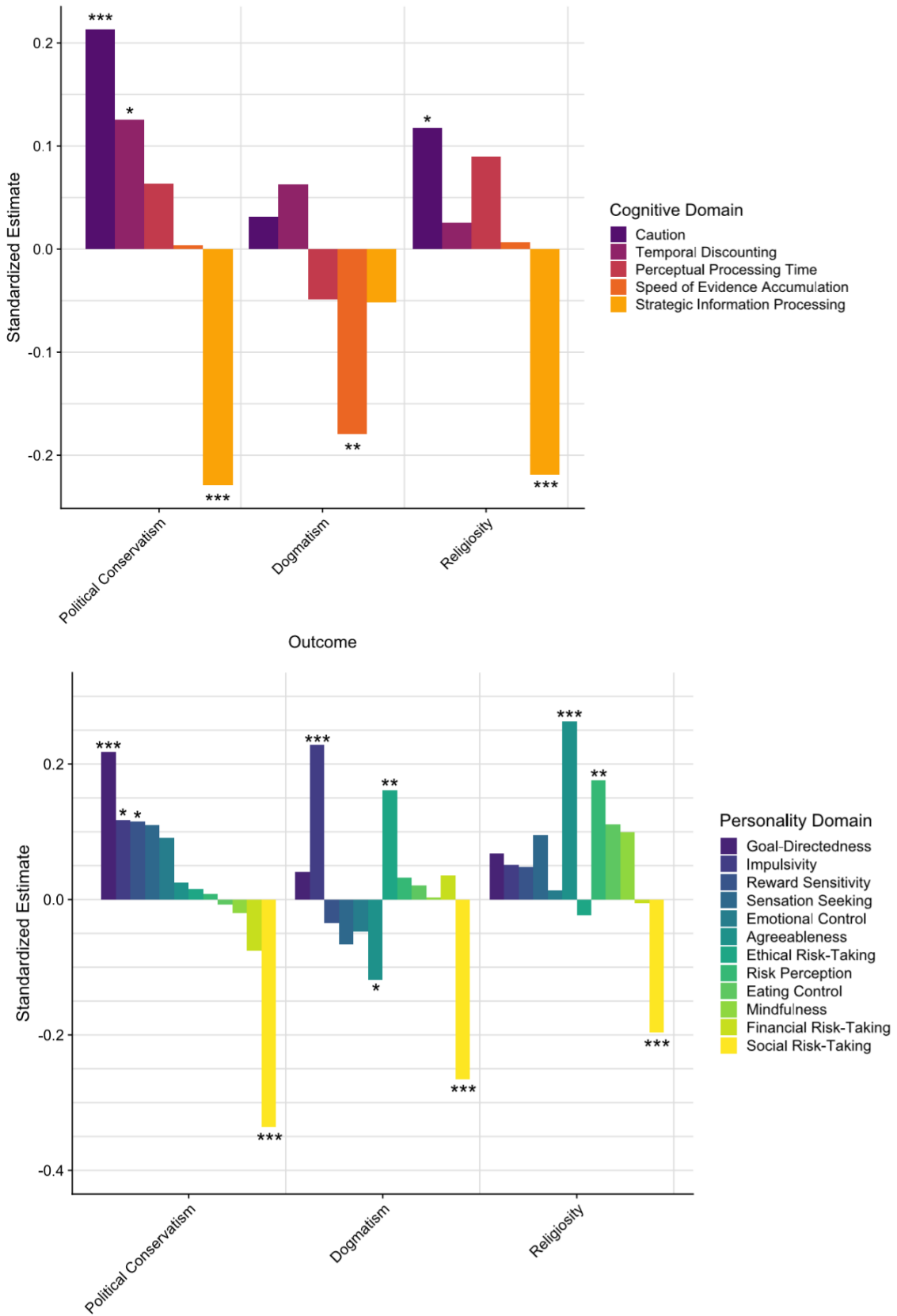
We further sought to identify the “best” model for each of the three ideological factors using a Bayesian Model Averaging approach (implemented in the *bic.glm* function in the *bma* R package (Raftery & Painter, 2005)) for all possible linear additive



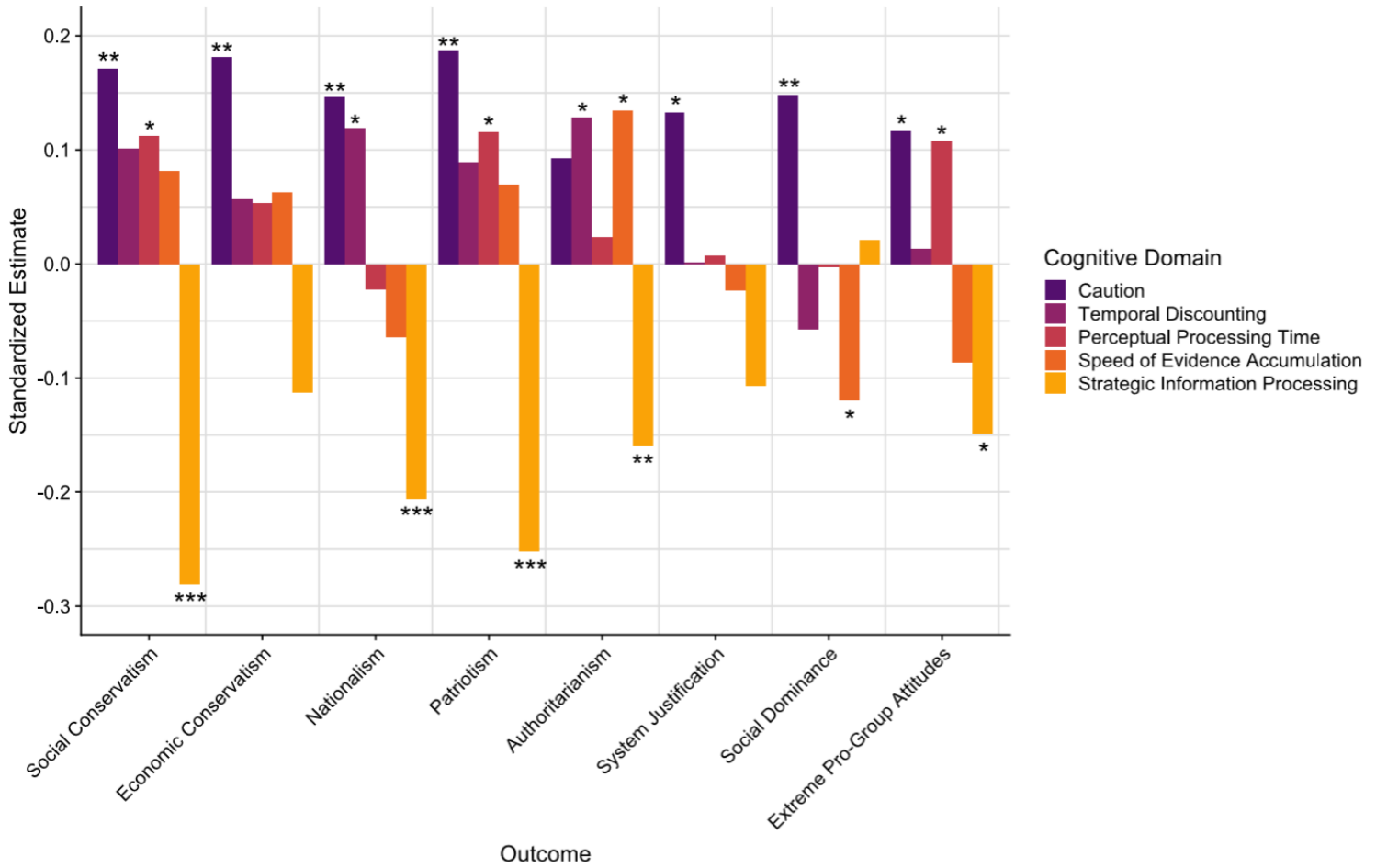
models using the cognitive task variables, personality survey variables, and demographic variables as regressors. The `bic.glm` function fits generalized linear models with the “leaps and bounds” algorithm and the Bayesian information criterion (BIC) approximation to Bayes factors (Hoeting et al., 1999). In Bayesian Model Averaging, inference about each variable is based on the averaging of posterior distributions of all considered models – rather than a single selected model – given the present data (see Figure 6.S2 for all included models in the Bayesian Model Averaging). We used a Gaussian error distribution and defined selected variables as having a posterior probability above 75% in line with past guidelines (e.g. Viallefont, Raftery, & Richardson, 2001; Jeffreys, 1961). For each of the three ideological factors, we then obtained the Bayes factors for the regression model composed of these selected variables. This approach excludes unnecessary predictors and allows us to generate the Bayesian regression that exhibits the best combination of fit and parsimony. As depicted in Figures 6.4 and 6.6, each ideological factor was best predicted by a different set of variables, all of which were consistent with the results of the standardized estimates from the multiple linear regression (see Figure 6.7). These “best” models all possessed the highest level of evidential strength relative to an intercept-only null model ( $BF_{10}$ ) and relative to a demographics-only ( $BF_{dem}$ ) model (Political Conservatism:  $BF_{10}=1.428\times 10^{13}$ ,  $BF_{dem}=1.825\times 10^{11}$ ; Dogmatism:  $BF_{10}=1.877\times 10^9$ ,  $BF_{dem}=1.386\times 10^{11}$ ; Religiosity:  $BF_{10}=1.049\times 10^8$ ,  $BF_{dem}=1.285\times 10^9$ ).



**Figure 6.6.** Posterior probability that each variable ( $\beta_i$ ) is non-zero given the data,  $D$ , (in %) following Bayesian Model Averaging on each of the three ideological factors. Selected variables for the “best” Bayesian regression possessed a posterior probability above 75% (red dotted line).



**Figure 6.7.** Standardized estimates of cognitive and personality variables for each ideological factor. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .



**Figure 6.8.** Standardized estimates of cognitive variables for ideological orientations that load on the Political Conservatism factor. Derived from multiple regression model predicted by cognitive variables only. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

## 6.4 Discussion

While the field of political psychology has expanded and flourished over the past two decades, to the best of our knowledge there has been no systematic and well-powered quantification of the contribution of psychological traits to ideological beliefs. By administering an unprecedented number of cognitive tasks and personality surveys and employing a data-driven mental ontology (Eisenberg et al., 2018), we were able to evaluate the predictive power of cognition and personality to ideological inclinations. Multiple linear regression analyses (Figure 6.3), Bayesian model comparisons (Figure 6.4), and out-of-sample cross-validated prediction (Figure 6.5) converged to demonstrate that cognitive and personality assessments consistently outperform demographic predictors in accounting for individual differences in ideological preferences. This revealed that incorporating psychological factors into statistical models of ideological attitudes increases explanatory power by 4 to 15-fold relative to solely relying on demographic factors (Figure 6.3). Bayesian analysis highlighted that the most parsimonious and predictive models include both behaviourally-assessed cognitive variables and self-reported personality variables (Figures 6.4 and 6.6), suggesting that both measurement types are valuable for predicting ideological behaviour and should be treated as complementary sources of explained variance.

Here we adopted a domain-general approach to ideology by examining a range of ideological attitudes pertaining to politics, nationalism, religion, and dogmatism. This exposed remarkable similarities and differences between the cognitive and personality correlates of diverse ideological orientations, demonstrating that there may be core psychological underpinnings of ideological thinking across domains (such as the roles of strategic information processing and social risk-taking; Figures 6.4, 6.6, 6.7 and 6.S3-S6) as well as specificity that depends on the content of the ideological domain (such as the differing roles of caution, impulsivity, and agreeableness). Furthermore, the results suggest that the relative contributions of demographic, cognitive, and personality predictors vary across the three ideological domains. For instance, demographic variables significantly predicted individual

differences in political and nationalistic ideological orientations, but not dogmatism or religiosity (Figure 6.4). Within the political ideologies, the cognitive ontology predicted social conservatism, nationalism, and patriotism very well, but predicted social dominance orientation and system justification to a lesser degree (Figure 6.3), suggesting that cognitive traits may have differential effects depending on the nature of the ideology. Moreover, in line with past research (Van Hiel et al., 2016), the personality survey ontology was more predictive of ideological attitudes than the cognitive task ontology (Figures 6.3, 6.4, 6.S3-S6); an effect that was more pronounced for dogmatism and religiosity than political conservatism, highlighting the importance of both measurement types.

In terms of political conservatism, the most predictive psychological correlates included reduced strategic information processing, heightened caution, and an aversion to social risk-taking (Figures 6.6, 6.7, 6.8). These three predictors were consistently implicated in the general political conservatism factor (Figure 6.7), as well as the specific political ideological orientations studied, such as nationalism, authoritarianism, and social conservatism (Figures 6.8 and 6.S3). These data-driven findings are remarkably congruent with existing theoretical and empirical accounts within political psychology and also add important insights. Firstly, the finding that political and nationalistic conservatism is associated with reduced strategic information processing is consistent with a large body of literature (for reviews see: Jost, 2017 and Van Hiel et al., 2016) indicating that right-wing ideologies are frequently associated with reduced analytical thinking (e.g. Hodson & Busseri, 2012; Onraet et al., 2015) and cognitive flexibility (Zmigrod et al., 2018, 2019b). Additionally, conservative political ideology was characterized by a diminished tendency to take social risks (Figures 6.7 and 6.S3) such as disagreeing with authority, starting a new career mid-life, and speaking publicly about a controversial topic. This corroborates research showing that political conservatives tend to emphasize values of conformity, ingroup loyalty, and traditionalism (Caprara, Schwartz, Capanna, Vecchione, & Barbaranelli, 2006; Cavazza & Mucchi-Faina, 2008; Feldman, 2003; Jost, Basevich, Dickson, & Noorbaloochi, 2016; Jost, Ledgerwood, Hardin, 2008; Piurko, Schwartz, & Davidov, 2011; Schwartz, Caprara, & Vecchione, 2010). These empirical consistencies

between the current data-driven findings and past theory-motivated research endow this line of work with further reliability.

Furthermore, we found that a politically conservative – that is, careful and socially-vigilant – outlook was associated with greater caution in ideologically-neutral speeded decision-making tasks, as operationalized in terms of the drift-diffusion model parameter for the amount of evidence required before committing to a decision. Specifically, the caution with which individuals process and respond to politically-neutral information was related to the conservatism with which they evaluate socio-political information (Figures 6.7 and 6.8). It therefore appears that caution may be a time-scale independent decision strategy that is evident both in speeded two-forced choice paradigms as well as slower and cumulative higher-order decisions about political issues. This finding supports the idea of “elective affinities” between cognitive dispositions and ideological inclinations (Jost, Federico, & Napier, 2009) and is compatible with the perspective that political conservatism is associated with heightened motivations to satisfy dispositional needs for certainty and security (Jost et al., 2003a, 2008, 2017). This theory is based on a wealth of research implicating sensitivity to threat, negativity, and uncertainty in conservatism (e.g. Hibbing et al., 2014). For example, under conditions of uncertainty, threat, or time pressure, individuals exhibit a conservative shift in their attitudes and choices (Landau et al., 2004; Cohen, Ogilvie, Solomon, Greenberg, & Pysz, 2005; Jost et al., 2004; Hansson, Keating, & Terry, 1974; Hetherington & Suhay, 2011; Nail et al., 2009). Nonetheless, to the best of our knowledge, ideological attitudes have never before been investigated in relation to caution as measured with cognitive tasks and drift-diffusion parameters. The present results therefore offer a novel addition to this literature by suggesting that political conservatism may be a manifestation of a cautious strategy in processing and responding to information that is both time-invariant and ideologically neutral, and can be manifest even in rapid perceptual decision-making processes.

The findings reveal further novel insights by highlighting that ideological orientations that have been widely studied and debated in political psychology exhibit both uniformity and variability in their cognitive and personality predictors. For

example, while social and economic conservatism possessed many overlapping correlates (such as heightened goal-directedness and caution; Figure 6.8 and 6.S5), economic conservatism was associated with enhanced sensation-seeking whereas social conservatism was not, and in turn social conservatism was related to heightened agreeableness and risk perception, while economic conservatism was not (Figure 6.S5). This bears on recent debates regarding the need to fractionate conservatism into its social and economic components in order to effectively and comprehensively understand its psychological underpinnings (e.g. Crawford et al., 2017; Malka, Lelkes, & Soto, 2017; Azevedo, Jost, Rothmund, & Sterling, 2019; Zmigrod et al., 2019b), and highlights sensation-seeking and risk perception as potential candidates for future study. The results can also help to disambiguate past debates about the conceptual overlaps between ideological orientations such as social dominance orientation, system justification, and authoritarianism (for review see: Sibley & Duckitt, 2008) and their differential predictive power in relation to real-world outcomes such as prejudice (e.g. McFarland, 2010; Brandt & Crawford, 2016; Cohrs & Asbrock, 2008) and policy attitudes (e.g. Jylha & Akrami, 2015). Here, we found that each of these ideologies exhibited a different cognitive and personality signature, with several notable patterns. For instance, system justification was the only political ideological orientation to be associated with elevated levels of emotional control (Figure 6.S5) – a pattern that system justification theory (for review see: Jost, 2018) may benefit from exploring further. Moreover, in the cognitive domain, while authoritarianism was related to *faster* accumulation of evidence and a tendency towards greater discounting of delayed rewards, social dominance orientation was associated with *slower* evidence accumulation and greater caution (Figure 6.8). Theoretical work and empirical replication by political psychologists and social dominance orientation researchers (for review see: Sidanius, Pratto, Van Laar, & Levin, 2004; Sidanius, Cotterill, Sheehy-Skeffington, Kteily, & Carvacho, 2016) will be necessary in order to elucidate how these data-driven findings fit in with existing conceptualizations of authoritarianism and social dominance orientation.

The dogmatism factor was best and most parsimoniously predicted by a different set of psychological variables to those that underpin political conservatism.



Dogmatic participants were slower to accumulate evidence in speeded decision-making tasks but were also more impulsive and willing to take ethical risks (Figure 6.7 and 6.S6). This combination of traits – impulsivity in conjunction with slow and impaired accumulation of evidence from the decision environment – may result in the dogmatic tendency to discard evidence prematurely and to resist belief updating in light of new information. This psychological signature is novel and should inspire further research on the effect of dogmatism on perceptual and decision-making processes. It is noteworthy that impulsivity differs here from caution (implicated in political conservatism and religiosity) in terms of measurement method (self-report survey versus behavioural task) and its relationship to self-control: caution here is operationalized as a trade-off between speed and accuracy under conditions where both are rewarded and so is under the influence of some strategic control, whereas impulsivity is typically conceptualized as a deficit in inhibitory control rather than a strategic trade-off (Dalley, Everitt, & Robbins, 2011). Consequently, dogmatic individuals may possess reduced inhibition that could be compounded by slower information uptake, leading to impulsive decisions based on imperfectly processed evidence. There has been remarkably little contemporary research on the cognitive basis of dogmatism, with a few exceptions (Brown, 2007; Deffler, Leary & Hoyle, 2016; Leary et al., 2016; Rollwage et al., 2018; Zmigrod et al., 2019a), and so we hope these findings will stimulate further in-depth research on the nature of dogmatic thinking styles.

The psychological signature of religiosity consisted of heightened caution and reduced strategic information processing in the cognitive domain, and enhanced agreeableness, risk perception, and aversion to social risk-taking, in the personality domain (Figures 6.7, 6.S5, 6.S6). Religiousness has been previously linked to factors associated with lower strategic information processing (e.g. Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Zuckerman, Silberman, & Hall, 2013; Lynn, Harvey, & Neyborg, 2009; Willard & Norenzayan, 2013; Zmigrod et al., 2018), heightened agreeableness (for meta-analysis see Saroglou, 2010), and avoidance of social risk-taking through conformity (e.g. Saroglou, Delpierre, & Dernelle, 2004). The finding that religious participants exhibited elevated caution and risk perception is

particularly informative to researchers investigating the theory that threat, risk, and disgust sensitivity are linked to moral and religious convictions (e.g. Fincher & Thornhill, 2008, 2012; Murray, Kerry, & Gervais, 2019), and that these cognitive and emotional biases may have played a role in the cultural origins of large-scale organized religions (Norenzayan, 2013; Purzycki et al., 2016). The results support the notion that experiencing risks as more salient and probable may facilitate devotion to religious ideologies that offer explanations of these risks (by supernatural accounts) and ways to mitigate them (via religious devotion and communities).

The present data-driven analysis produced results that are largely consistent with prevailing conceptualizations of the psychology of ideological beliefs, but also revealed cognitive signatures of ideological thinking that have not yet been investigated. The findings demonstrated large effect sizes and strong evidence for predictive models of ideological orientations that incorporate demographic, cognitive and personality factors (Figures 6.3, 6.4). By adopting research practices such as relying on large samples, integrating assessment methods from cognitive and social psychology, utilizing both frequentist and Bayesian statistical techniques, and temporally separating the collection of psychological and ideological data, the current investigation was able to overcome many methodological concerns in social and political psychology regarding biased hypothesis generation and reproducibility (e.g. Duarte et al., 2015). The convergence between the present data-driven results and past theory-driven research helps to validate existing findings and to highlight the degree to which human ideological inclinations are rooted in cognitive dispositions. Moreover, this data-driven approach generated notable novel insights that will help guide future research, such as the role of evidence accumulation rates and impulsivity in dogmatism, or the manifest relationship between cognitive caution and political conservatism (Figures 6.7 and 6.8). These findings underscore the fruitfulness of examining the relationships between high-level ideological attitudes and low-level perceptual processes, and suggest that ideological beliefs are amenable to careful cognitive and computational analysis. Future cumulative research will need to elucidate the question of causality. Recent accounts suggest that not only do psychological processes underlie ideological attitudes, attitudes also guide behaviour

and decision-making across domains in ways that can shape perception, cognition, and personality (Hatemi & McDermott, 2016). A holistic, domain-general approach to the relationship between ideology and cognition can therefore offer a valuable foundation for research on the psychological roots of intergroup attitudes, xenophobia, and ideological extremism.



# 7

## Chapter 7

### General Discussion



## 7 General Discussion

### 7.1 Summary and Synthesis

#### 7.1.1 Overview of Aims

The research program detailed and developed in this doctoral dissertation was guided by the question: *what traits make some individuals more susceptible to ideological thinking than others?* By invoking “traits”, the research was concerned with stable individual differences in cognitive information processing and personality characteristics. By referring to “ideological thinking”, the research explored the notion that ideologies – regardless of their content or ambition – attract and inculcate a common type of thinking in their adherents. Ideological thinking is characterized by strong adherence to an ideological cause and resistance to belief-updating, as well as a parochial relational orientation that is strongly favourable to ingroups and antagonistic to outgroups. It was therefore reasoned that ideological thinking could become manifest across a range of ideological commitments, including nationalism (Chapters 2 and 6; Zmigrod, Rentfrow, & Robbins, 2018), religious fundamentalism (Chapters 3 and 6; Zmigrod et al., 2018), extreme political partisanship (Chapters 4 and 6; Zmigrod et al., 2019b), attitudinal dogmatism (Chapters 5 and 6; Zmigrod et al., 2019), and a selective favouritism towards ingroups over outgroups<sup>10</sup> (Chapter 6; Zmigrod, Rentfrow, & Robbins, 2019a, 2019b). Within this definition of “ideological thinking” lies an assumption as well as a hypothesis that was tested throughout the series of studies that constitute this doctoral research: *there is remarkable uniformity in the psychological underpinnings of diverse ideological convictions.*

The epistemological motivation for this premise resides in questions regarding the *form* and *structure* of ideological thinking, rather than the *content* of ideological beliefs. In this regard, this line of inquiry departs from a majority of existing psychological research on politics, morality, religion, or intergroup relations. The

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<sup>10</sup> Operationalized specifically in Chapter 6 in terms of extreme pro-group attitudes.

focus of past research has often been on how specific beliefs about social institutions or groups relate to psychological processes (for reviews: Jost, 2017; Norenzayan, 2013, 2016). Research on these questions is currently divided into the disciplines of “political psychology”, “psychology of religion”, “moral psychology”, and “intergroup psychology”, and so researchers are typically interested in single ideological domains and their associated beliefs (e.g. conservatism, religiosity, moral values, and prejudice) rather than the overarching psychological similarities (and differences) across ideological domains.

Consequently, one important way in which the studies outlined here differ from past research exists in the impulse to identify psychological factors that are implicated in ideological thinking *generally*. A second point of departure from previous approaches is the emphasis on studying ideological cognition by merging the tools of cognitive science and social psychology rather than using self-report measures to infer cognitive traits. Lastly, the current research sought to integrate theory-driven and data-driven methodologies in order to generate research that overcomes past methodological weaknesses in the field and facilitates reproducible research practices. This combination of approaches allowed for the development of a more precise understanding of the similarities and differences in the cognitive underpinnings of diverse ideological convictions. In the following, the main conclusions from each chapter will be summarized, followed by a synthesis of three overarching conclusions that can be drawn from this doctoral research.

### **7.1.2 Summary of Findings**

While there is convergence in the general approach and objectives of the chapters outlined here, each study examined a distinct manifestation of ideological thinking and identity, and studied it in relation to a different combination of psychological variables. Each chapter employed a range of statistical techniques to explore the data and each resulted in nuanced empirical observations. A brief summary of the main findings of each chapter will be delineated here.



Chapter 2, “Rigidity of Thought and Inflexible Borders: A Cognitive Analysis of British Nationalism”, began with the premise that nationalistic ideologies tend to have firm categories and rules for what belongs to and represents the national culture. This led to the hypothesis that nationalistic individuals would tend to think in more inflexible and categorical terms about non-ideological stimuli. Using voting behaviour and attitudes from the UK’s 2016 EU Referendum, we found that a flexible representation of national identity and culture was linked to cognitive flexibility in the ideologically-neutral WCST and the RAT, and to self-reported flexibility under uncertainty. Structural equation modelling revealed that subjective and objective cognitive inflexibility predicted heightened authoritarianism, nationalism, conservatism, and system-justification, and these in turn were predictive of support for Brexit and opposition to immigration, the EU, and free movement of labour. This model accounted for 47.6% of the variance in support for Brexit. Path analysis models were also predictive of participants’ sense of personal attachment to the UK, signifying that individual differences in cognitive flexibility may contribute towards ideological thinking styles that shape both nationalistic attitudes and personal sense of nationalistic identity. This is particularly notable given the scarcity of empirical studies conducted on the topic of nationalism, and given that nationalism is often an ideological orientation that is evident across both the political left and the political right. The findings suggested that information processing styles in relation to perceptual and linguistic stimuli may be drawn upon in the evaluation of political information and in the formation of ideological identities, such that the rigidity of one’s perception and cognition is manifest in the rigidity of their ideological sentiments.

Chapter 3, “Cognitive Flexibility and Religious Disbelief: The Roles of Ideological Rituals, Identity, and Upbringing”, similarly considered the role of flexibility of thought in ideological thinking, but focused on religiosity. It drew on the literature of the cognitive science of religion, which has highlighted that religious belief systems consist of strict rules and rituals that offer adherents certainty, consistency, and stability. It was therefore hypothesized that religious adherence and practice of repetitive religious rituals may be related to the persistence versus

flexibility of one's cognition. The study investigated the extent to which tendencies towards cognitive flexibility versus persistence are related to three facets of religious life: religious affiliation, religious practice, and religious upbringing. In a large sample (N=744), we found that religious disbelief was related to cognitive flexibility across the WCST, RAT, and AUT. Furthermore, lower frequency of religious service attendance was related to cognitive flexibility. When analysing participants' religious upbringing in relation to their current religious affiliation, it was manifest that current affiliation was more influential than religious upbringing in all the measured facets of cognitive flexibility. The findings indicate that participation in religious ideologies may shape and be shaped by cognitive control styles towards flexibility versus rigidity, highlighting that ideological affiliation, engagement, and upbringing may have different psychological antecedents and consequences.

Building on these findings, Chapter 4, "Ideological Symmetries: Testing the Ideological Extremity Hypothesis in American Political Partisanship", sought to dissect the various components of ideological identity and participation in the context of US politics. It challenged the reliance of past research on single-item measures of political conservatism, and their unwarranted use in assessing political extremity<sup>11</sup>. It also questioned the tendency of research in political psychology to discard political independents from primary analyses. Notably, contemporary political psychology has dealt with the cognitive rigidity account since the publication of *The Authoritarian Personality* (Adorno et al., 1950), and this has led to two competing hypotheses. The prominent *rigidity-of-the-right hypothesis* argues that mental rigidity is related to a conservative political orientation, while the *ideological extremity hypothesis* suggests that rigidity is associated with partisan extremity across the political spectrum. The study detailed in Chapter 4 revealed that partisan extremity predicted reduced cognitive flexibility, regardless of political orientation, across three independent cognitive assessments of flexibility. This was evident across multiple statistical analyses, including quadratic regressions, Bayes factor analysis, and interrupted

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<sup>11</sup> Whereby individuals who indicated they were "very liberal" or "very conservative" were automatically coded as "extreme".

regressions. These findings signify that the rigidity with which individuals process and respond to non-political information may be related to the extremity of their partisan identities. This constituted the first direct testing of the two hypotheses using behavioural measures of cognitive inflexibility, revealing that sensitive measures of ideology and cognition can help resolve disputed theoretical debates.

Chapter 5, “Deconstructing Dogmatism: The Interaction of Cognitive Flexibility and Intelligence”, adopted a complementary approach to that of Chapters 2-4 and instead of focusing on a coherent ideological identity or set of convictions it examined *intellectual humility* – the recognition of one’s own potential fallibility when forming and revising attitudes. The results indicated that intellectual humility was positively associated with cognitive flexibility on the AUT and with intelligence (measured with the Raven’s Advanced Progressive Matrices). These relationships were pronounced for the facets of intellectual humility associated with respect for opposing opinions and openness to revising one’s attitudes in light of new evidence. The data revealed an interaction: high cognitive flexibility is particularly valuable for intellectual humility in the context of low intelligence, and reciprocally, high intelligence is beneficial for intellectual humility in the context of low flexibility. Notably, there was evidence of a compensatory effect, as participants who scored highly on both flexibility and intelligence did not exhibit superior intellectual humility relative to individuals who scored highly on only one of these cognitive traits. These findings are suggestive of dual psychological pathways to intellectual humility; either cognitive flexibility or intelligence is sufficient for high intellectual humility, but neither is necessary. The interactionist perspective adopted in Chapter 5 highlights the importance of considering moderation effects when studying such complex phenomena and compilation of traits – this will be discussed further as a fruitful avenue for future research in section 7.2.

Lastly, Chapter 6, “A Data-Driven Approach to the Psychological Correlates of Ideological Attitudes”, built on the convergent finding from Chapters 2-5 that it is fruitful and productive to embrace an individual differences perspective to study the cognitive underpinnings of various ideological orientations. However, it departed

from the theory-driven approach of Chapters 2-5 and instead relied on a unique dataset compiled in collaboration with researchers at Stanford University to apply a data-driven approach to these questions. Using an unprecedented number of cognitive tasks and personality surveys, and data-driven derivation of mental structure, we conducted the first rigorous, systematic quantification of the relative contributions of demographics, personality, and cognition to individuals' ideological inclinations. The findings illustrate that psychological variables consistently outperform demographic variables in accounting for political conservatism, religiosity, and dogmatism. A combination of novel data-analytic strategies including in-sample linear regression, out-of-sample cross-validation, and Bayesian Model Averaging, revealed that including psychological traits increased explanatory power by 4- to 15-fold. Furthermore, we uncovered the psychological dispositions that were most strongly linked to individuals' ideological orientations, revealing the cognitive and personality signatures of a large set of ideologies in the domains of nationalism, religion, politics, and dogmatism. Consequently, the findings of Chapter 6 are directly informed by and informative for the conclusions of Chapters 2-5.

### **7.1.3**     *Three Insights*

These findings yield three overarching conclusions. Firstly, the results of Chapters 2-6 shed light on cognitive traits that are implicated in domain-general ideological thinking as well as those that play a role only in specific ideological orientations (Section 7.1.3.1 below). Secondly, the findings challenge past assumptions that socioeconomic context and emotional processes are the most powerful predictors of how people will vote and what they will believe - illustrating that "cold" non-emotional processes matter too (Section 7.1.3.2 below). Lastly, this body of work provides support to the notion that ideological cognition should be studied as a separate, integrative phenomenon in the psychological and behavioural sciences, and that such an approach could help illuminate complex societal challenges and address gaps in our theoretical and applied knowledge (Section 7.1.3.3 below).

### 7.1.3.1 *Ideological Similarities and Differences: (When) Does Ideological Content Matter?*

Across this set of studies, it has become manifest that there are several cognitive and personality traits that are consistently implicated in strong possession of ideological beliefs. Heightened *cognitive rigidity* (Chapters 2-5), response *caution* (Chapter 6), and *aversion to social risk-taking* (Chapter 6) reliably emerged as individual difference factors that characterize people with tendencies towards ideological thinking in relation to nationalism, religion, political partisanship, and dogmatism. Chapters 2-6 jointly illustrate that the intensity and strictness of one's adherence to an ideology therefore appears to be as relevant to – and revealing of – one's mental flexibility and psychological makeup as the content of one's favoured ideology. The results of these studies suggest that the cognitively inflexible mind may be especially susceptible to the clarity, certainty, and safety frequently offered by strong loyalty to collective ideologies and doctrines, regardless of their subject matter and motivation.

Despite these similarities, there is also substantial diversity in the psychological correlates of ideological convictions. Chapter 6 revealed that political conservatism, nationalism, and religiosity generally implicate reduced strategic information processing and heightened response caution, while general dogmatism did not. Dogmatism was uniquely associated with impaired accumulation of evidence in conjunction with impulsivity – a profile that was distinct from content-based ideologies. Moreover, as discussed in Chapter 6, even within the political ideologies, there was considerable variability. For instance, social and economic conservatism, which are measured as part of the same Social and Economic Conservatism Scale (SECS; Everett, 2013), were characterized by several discrepant personality correlates; economic conservatism was associated with enhanced sensation-seeking whereas social conservatism was not, and in turn social conservatism was related to heightened agreeableness and risk perception, while economic conservatism was not (Figure 6.5). Similarly, while authoritarianism and social dominance orientation have often been investigated in tandem (e.g. Asbrock, Sibley, & Duckitt, 2010; Duckitt & Sibley, 2007, 2009; Duriez & Van Hiel, 2002), we found that in spite of considerable psychological overlap, there were also notable differences. For example, while

authoritarianism was associated with *faster* accumulation of evidence and a tendency towards greater discounting of delayed rewards, social dominance orientation was associated with *slower* evidence accumulation and greater response caution (Figure 6.8). Theoretically-similar ideological orientations therefore exhibit both overlaps and differences in their psychological underpinnings. Consequently, studying the psychological similarities across domains can inform our understanding of the cognitive consequences and antecedents of ideological thinking generally, and identifying the discrepancies in cognitive underpinnings helps clarify the nature of diverse ideological convictions, and what it is that makes them different in the first place.

#### 7.1.3.2 *Beyond Pure Circumstance and Emotion*

There has been a long-held assumption in political science that socioeconomic circumstance and family upbringing are the most powerful predictors of individuals' beliefs, attitudes, and identities (e.g. Campbell et al., 1960). Adorno and colleagues (1950) already noted in *The Authoritarian Personality* that this is likely to be an oversimplification, but at the time lacked the empirical evidence to demonstrate this convincingly. Nonetheless, they wrote eloquently:

*“Even when individuals are exposed during their formative years almost exclusively to a single, closely knit pattern of political, economic, social, and religious ideas, it is found that some conform while others rebel, and it seems proper to inquire whether personality factors do not make the difference. The soundest approach, it would seem, is to consider that in the determination of ideology, as in the determination of any behaviour, there is a situational factor and a personality factor, and that a careful weighting of the role of each will yield the most accurate prediction.”* (Adorno et al., 1950, p. 9)

Chapter 6 exemplifies that we are able to carefully quantify the relative contributions of demographic and psychological factors in a data-driven fashion in order to illuminate that cognitive dispositions and personality traits play a substantial role in determining individuals' ideologies. This was also clearly evident in Chapter 2, in which nationalistic attitudes were predicted to a considerable degree by cognitive

traits. Interestingly, Chapter 3 adds nuance to this finding by illustrating that while ideological upbringing is less influential in predicting one's psychological tendencies than current ideological affiliation, one's upbringing – and the extent to which the individual departed from that upbringing in adulthood – does give a context to the expression of cognitive traits. In particular, nonreligious participants with a religious upbringing (i.e. those that chose to “leave” religion in favour of atheism) exhibited heightened cognitive flexibility on the RAT relative to all other groups. This raises a multitude of valuable questions about the nuanced interactions between environmental influences and cognitive traits, which deserve careful attention in future research.

Another strongly-held assumption by political scientists and social psychologists is that ideological beliefs are largely determined by our receptivity to emotional rhetoric, contagion, and intimidation (e.g. Goldenberg et al., 2016). To our knowledge, the current studies are amongst the first to suggest that ideological processes are not purely underpinned by ‘hot’ emotional processing, attitude-confirming biases, or moral foundations and values. Here it is shown that people's evaluation of ideological arguments and willingness to harm others for their group may also be rooted in ‘cold’ emotionally-neutral cognitive information processing tendencies. Thus, it is not only emotional processing or “psychological needs” that underlie individuals' adoption of ideologies; “cold” cognitive information processing styles also play a key role in ideological behaviour and identity. Cognitive dispositions may therefore need to be incorporated into prominent theories about the factors shaping extremism and self-sacrifice, such as significance quest theory (Kruglanski et al., 2014, 207) and identity fusion theory (Swann et al., 2010, 2012). This will facilitate research into the neural mechanisms that underlie these psycho-social processes, and offer insight into the extent to which political campaigns appeal not only to our emotions but also to voters' cognitive information processing tendencies.

### 7.1.3.3 *Studying Ideological Cognition as a Phenomenon*

An emergent conclusion from this set of studies is that it is possible, valuable, and perhaps socially-important to study ideological thinking and related processes under one umbrella, rather than in siloed subdisciplines of psychology. It is *possible* to consider ideological cognition as a separable phenomenon because the findings indicate that there are core commonalities in the substrates of adherence to ideological doctrines regardless of their content. There are therefore psychological dispositions, situational factors, and neurobiological characteristics that can predispose an individual to process and respond to the world in an ideological fashion. Consequently, it is *valuable* to cluster these behaviours and susceptibilities in common terms and under unified theoretical frameworks if scientific endeavours to deconstruct these phenomena are to be meaningful and applicable. Lastly, there is considerable *societal utility* in comprehending the susceptibility factors – and antidotes – to attitudes that are dogmatic and hostile to dissimilar others. Given the kaleidoscopic diversity of mass movements, doctrines, and regimes that characterize human history and culture, isolating and defining the core processes of ideological adherence, immersion, and extremism is a pressing academic and applied task.

One of the most profound results from the current studies is that ideologically-neutral cognitive processes that manifest in simple trial-by-trial decision-making are related to higher-level ideological convictions and beliefs. This is suggestive of *domain-general* and *time-invariant processes* and strategies that operate on multiple time scales and across a variety of contexts. That is, the rigidity, caution, and accumulation of sensory and reinforcement evidence on a neutral two-forced choice paradigm was related to the rigidity, caution, and insensitivity to evidence manifest in the individual at higher-order goals and temporally-longer strategies. This suggests a correspondence between the cognitive mechanisms governing stimulus-response relationships in simple perceptual tasks and the cognitive processes that underlie evaluation of ideological arguments. This raises a number of key questions regarding the neural and behavioural instantiation of these shared mechanisms as well as the causal structure of these processes. Do the relationships identified in this research



indeed emerge from low-level rigidity at the stimulus-response level that becomes manifest in higher-order information contexts? Does engagement with ideological doctrines lead to rigidity through alterations of the individual's low-level perceptual systems? If so, what environmental and neural mechanisms mediate this set of changes?

The Identity-Based Model of Political Belief sketched out by Van Bavel and Periera (2018) generally posits that partisan identities influence the value attached to different beliefs, and so shape attentional control, memory, implicit evaluation, and executive functioning. To support this, Van Bavel and Periera (2018) cite research illustrating how knowledge of others' political affiliations and social identities changes visual perception of and attention to identity-relevant videos and events (Caruso, Mead, & Balci, 2009; Granot et al., 2014; Kahan et al., 2012; Molenberghs et al., 2013). Nonetheless, this model concerns what happens to cognitive systems when the brain processes politically-valenced or identity-relevant information, rather than how the brain processes and responds to the world in general when it is under the overarching influence of ideologies, or how ideological thinking can infiltrate processing of non-political information.

The task of characterizing the mediating mechanisms between general cognition and ideological cognition will require interdisciplinary efforts, including the incorporation of computational methods, neuroscientific paradigms, and a systematic study of other fields which have drawn parallels and identified shared mechanisms between perceptual representations and higher-order psychological processes. Novel lines of inquiry in the realm of political neuroscience have already begun to unpack these questions. There is now some evidence that amygdala structure and function relate to individual variability in ideological positions and attitudes (Kanai, Feilden, Firth, & Rees, 2011; Nam, Jost, Kaggen, Campbell-Meiklejohn, & Van Bavel, 2018), and that the disgust evoked by non-political images and stimuli can predict political ideology in US participants (Ahn et al., 2014; Liuzza et al., 2018). There is even evidence that prefrontal cortex activity during intergroup fairness games tracks participants' identity fusion to the group (Apps, McKay, Azevedo, Whitehouse, &

Tsakiris, 2018), suggesting that the impact of identity processes on social behaviour is related to prefrontal cortex processing. However, there is still substantial work that needs to be done in order to elucidate the underlying mechanisms. Do we observe these findings simply because these regions are implicated in high-level cognitive/emotional processing as well as processing information about social groups? Or is there a deeper process at play, in which low-level perceptual tendencies and neural architecture directly support the emergence of ideological attitudes and dogmatic or parochial processing of information? Scientists of ideological and intergroup thinking will need to tackle difficult questions about *why* we observe correspondences between social attitudes and cognitive structure, and what behavioural and neural mechanisms underpin these correspondences. While this may sound like a reductionist enterprise, understanding ideological cognition in terms of the mechanistic principles of perception and neuroscience will only enrich our understanding of these high-level behaviours. We need to be as rigorous and mathematical in our investigation of ideological cognition as psychologists and neuroscientists are about temporal cognition, modal cognition, and sensory perception – echoing Spinoza’s words that we can “analyse the actions and appetites of men as if it were a question of lines, of planes, and of solids” (Spinoza, 1677/2017).

## **7.2 Future Research**

The research outlined here has sparked numerous valuable research questions for future inquiry. Firstly, the findings call for further investigation into the precise mechanisms that underlie how cognitive traits give rise to individuals’ ideological orientations and identities. An assumption underlying the present studies is that domain-general cognitive rigidity translates into ideological rigidity because general mental inflexibility will lend itself towards inflexible processing and evaluation of ideological arguments and a greater reliance on rigid social categories. Nonetheless, to corroborate this idea, future studies will need to develop methods that can directly quantify the rigidity with which arguments are evaluated and incorporated into individuals’ mental schemas of these concepts. This will allow us to more directly test whether the underlying mediational hypothesis is indeed at play. Methods will also

need to be designed that tap into the way in which rigid social categories shape cognition and decision-making. This will involve assessing contexts when these ingroup-outgroup social categories are either task-relevant or task-irrelevant in order to evaluate the global psychological effects of adhering to sharp categorical “us-vs-them” distinctions. There is therefore room for empirical research and design that will carefully interrogate the mechanistic explanations hypothesized here.

Secondly, one major area of future investigation will be to examine how these “cold” non-emotional cognitive processes interact with “hot” emotional traits and contexts. There is a growing research on the role of emotional processes (DeSteno, Dasgupta, Bartlett, & Cajdric, 2004; Goldenberg, Halperin, van Zomeren, & Gross, 2016; Zaki & Cikara, 2015) and of emotionally-implicated neural substrates (Nam et al., 2018) in shaping intergroup attitudes. Nonetheless, there is little to no research about the interaction between (non-emotional) cognitive and emotional traits in influencing susceptibility to engaging with collective ideologies. For instance, do specific patterns of reactivity to threatening stimuli combined with cognitive rigidity elevate susceptibility in an additive or multiplicative fashion? Or does a heightened capacity to regulate one’s emotions buffer against the effects of cognitive rigidity on ideological rigidity? These “cold” and “hot” cognition effects are all interactions that need to be empirically specified and examined in order to develop a more comprehensive picture of the factors that can predispose an individual to ideological thinking.

Along these lines, a future direction for research involves examining how situationally-activated motivations (as extrapolated in the motivational accounts of social identity and political conservatism outlined in Chapter 1) interact with these dispositions. Future research on the psychological roots of radicalization and extremist attitudes will need to address how non-emotional cognitive styles interact with other individual-level motivational risk factors such as the quest for personal significance (Kruglanski et al., 2014), identity fusion (Swann et al., 2010; Whitehouse, 2018), the need to belong (Lyons-Padilla et al., 2015; Littman & Paluck, 2015), and sacred values (Atran, 2010; Ginges, 2019; Sheikh, Ginges, Coman, & Atran, 2012). Are

individuals with certain cognitive dispositions more resistant or susceptible to situations that might motivate individuals to seek existential answers or social connectedness? And crucially, are these traits that we can cultivate in order help confer resistance to radicalization in vulnerable populations?<sup>12</sup> As outlined throughout the dissertation, there is growing evidence that cognitive flexibility is malleable and trainable with simple interventions (e.g. Colzato, Ozturk & Hommel, 2012; Colzato et al., 2017; Fleith, Renzulli, & Westberg, 2002; Kleibeuker et al., 2017; Scott et al., 2004, Stevenson et al., 2014) and so early educational programs in schools that emphasize cognitive flexibility may facilitate intergroup perspective-taking and reduced prejudice (e.g. Diamond & Lee, 2011). Consequently, the study of interactions amongst situations, motivations, and traits could hold important promise for both our academic and applied understanding of ideological phenomena and the emergence of mass movements.

In addition to considering the broader high-level factors that may shape individuals' susceptibility to collective ideologies, it will also be instrumental for future research to consider the underlying low-level neurobiological factors that can amplify or buffer against risk. The present research suggests that biologically-grounded cognitive traits are implicated in formation and maintenance of ideological identities, and so it may be promising to examine how neurobiological factors such as genetic traits and neuro-physiological characteristics shape cognition – and in turn ideological thinking. Building biologically-informed models of ideological cognition may therefore be a fruitful direction for this field to take as it continues to grow and mature.

Furthermore, the results have highlighted the need for novel assessment tools in order to facilitate a new “psychology of ideology”. There are three main avenues for this methodologically-oriented research that will have a particularly fruitful impact on future studies. Firstly, it is necessary to create a tool that assesses ideological

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<sup>12</sup> While making sure that any intervention program does not inadvertently result in unfavourable by-product outcomes such as social antipathy.

commitment, conviction, and attachment without invoking the particular content of that ideology. This is important in order to be able to truly compare the psychological correlates of diverse ideological orientations. One proxy to measuring the strength of ideological *identity* is the Identity Fusion index (used in Chapter 2 and Chapter 4), in which the participant is asked to move a small circle labelled “Me” in relation to a large static circle labelled with the name of the ideological group (e.g. a personally-relevant religious group, political party, nation). The amount of overlap between the two circles and the distance between the circles<sup>13</sup> can be used as a metric of personal feelings of immersion with the ideological group. The power of this measure lies in its applicability to any ideological or social group, such that the amount of identity fusion is quantifiable and translatable between ideologies.

Another attempt to do this is the Open-Minded Cognition Scale, in which the scale items can be easily adjusted to target general, political, or religious open-minded cognition (Price, Ottati, Wilson, & Kim, 2015). For instance, the 6-item scale contains items such as “I am open to considering other (political/religious) viewpoints” and “I have no patience for (political/religious) arguments I disagree with”. Nonetheless, recent work by Crawford, Brandt, and Germano (2018) challenges the predictive validity of the Open-Minded Cognition Scale and suggests that it may be best conceptualized as a measurement of *self-perceived* open-minded cognition rather than open-minded cognition itself (Crawford, Brandt, & Germano, 2018, p. 24). Consequently, there is still substantial room for methodological work that seeks to develop appropriate, reliable, and predictive measures that avoid social-desirability biases<sup>14</sup>.

The second methodological direction for future research is the need to clearly separate correlates of (1) the *doctrinal* aspects of ideological thinking (dogmatic reasoning that follows a ready-made doctrine and is resistant to belief updating in

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<sup>13</sup> Distance can be a useful measure when participants are explicitly told that they can also drag the “Me” circle away from “Group” circle to indicate distance or aversion.

<sup>14</sup> Indeed, a pictorial measure like the Identity Fusion index helps ameliorate these kinds of biases because there aren’t strong social norms regarding how “fused” one ought to be with a particular group on a continuous scale of 0-100.

light of new evidence) and (2) the *relational* components (ingroup favouritism, outgroup antagonism, and enforcement of rigid social norms). Ideological thinking as defined here possesses both components, and so it will be important to develop clear guidelines and frameworks for measuring each facet as well as their interactions. How do the doctrinal and relational aspects of ideological thinking emerge in tandem within an individual? How are the doctrinal and relational elements structurally related? That is, does one temporally precede the other and how do they reinforce and amplify each other? What personal and social experiences or motivations affect the emergence of each? Do they possess separable or similar cognitive correlates? What are the real-world manifestations of the relational component without a doctrinal component (e.g. avid sports fans<sup>15</sup>) or the reverse (e.g. lone suicide terrorists<sup>16</sup>)? Unpacking the structure of ideological thinking is therefore a key next step for this line of research.

Lastly, in order to advance a psychology of ideology, we must clearly delineate and study the whole process of ideological immersion, from exposure to adherence to extremism. Each stage between exposure to radical adherence and self-sacrifice is likely to have overlapping and unique susceptibility factors, and so we need appropriate assessment tools to evaluate individuals' position at each stage. This will require measurement tools that are both content-free and contextually-specific, since there are likely to be both similarities and differences in the trajectories and manifestations of ideological immersion for different doctrines. Indeed, developmental and longitudinal studies will be necessary in order to elucidate causal links and self-reinforcing loops between cognitive dispositions and ideological identity and behaviour.

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<sup>15</sup> However, arguably some fans are also resistant to information of poor performance by their team, and so the doctrinal aspect can exist in sports group memberships as well.

<sup>16</sup> Nonetheless, even when an individual is supposedly purely motivated by ideology, there is often the hope of social connectedness or recognition in the afterlife, and so the relational aspect can be evident here as well.

### 7.3 Limitations

All the studies presented here consisted of samples of participants recruited online. This constitutes a primary limitation of the current research, as online samples are often not perfect representations of the general population, and so inferences about psycho-political processes require that these studies are replicated in samples that are selected for their representativeness. Lab experiments will also help verify the reliability of these findings. The challenge with lab-based studies of this nature is that this may constrain the representativeness to even more extreme degrees – university students and populations around universities are often WEIRD (Henrich, Heine, & Norenzayan, 2010; Hruschka, Medin, Rogoff, & Henrich, 2018). Hence, there is considerable scope for replication work in nationally representative samples. Moreover, it is paramount to conduct cross-cultural work in order to make stronger claims about the psychology of ideology, especially given the diversity of political systems and levels of totalitarianism across the world today.

From the cognitive methodology perspective, the studies here are also limited to particular subsets of cognitive tests, and so it will be valuable for future research to examine a broader range of cognitive flexibility tests such as task-switching paradigms and probabilistic reversal learning tests in order to generate a comprehensive picture of the relevant facets of mental flexibility. Additionally, while the studies have sought to show the specificity of flexibility – rather than general cognition – in shaping ideological worldviews, it will be important to clearly and directly delineate the role of intelligence and cognitive ability as risk or resilience factors (as in Chapter 5). Indeed, the strength of Chapter 6 is its expansive cognitive dataset. However, in order to deal with such a large dataset we used factor analysis to reduce the dimensionality of the psychological data, but also lost some granularity as a result; the “strategic information processing” factor that is implicated consistently in political conservatism, nationalism, and religiosity, is a conglomerate of many high-level cognitive traits and so is difficult to fully interpret. This limitation is in part a weakness of available analytic methodologies – there are few tools that can robustly evaluate relationships in such a large data matrix without falling prey to questionable

research practices. Our use of Bayesian Model Averaging (BMA) helped alleviate this, but due to limitations in the software used to run these analyses, we could only run BMA on the 17 psychological factors and 4 demographic variables but not on the larger set of raw dependent variables (consisting of 129 cognitive dependent variables and 64 personality dependent variables). Advances in these analytic methods and the improvement of computational social science will hopefully allow us to revisit this analysis in the future to achieve an even more fine-grained understanding of exactly which cognitive tasks and personality survey items are most predictive of ideological attitudes.

Furthermore, there are limitations on the extent to which inferences about causality can be made here. Are the manifest relationships between cognitive traits and ideological orientations a *result* of engaging with ideologies or a *reflection* of the traits that confer susceptibility to ideological thinking in the first place? Moreover, what happens to these relationships in response to societal events such as when one's ideological position is either socially marginalized or accepted. There are three primary ways to disentangle this: (1) longitudinal research that tracks individuals over time, (2) experimental paradigms that manipulate the salience of ideological doctrines, and (3) retrospective questions that tap into past ideological upbringing and levels of engagement with the ideology (as in Chapter 3). Future research will also need to consider the likely possibility that cognition both *shapes* and *is shaped by* ideological worldviews, and so we will need to develop means to characterize and quantify the relative contributions of these two processes.



## 7.4 Conclusions

At the end of her landmark paper, “Intolerance of Ambiguity as an Emotional and Perceptual Personality Variable” published 70 years ago in 1949, the pioneering psychologist Else Frenkel-Brunswik concludes that:

*“There is more than an empirical affinity between the strength of hostility, of power-orientation, of externalization, and of rigid stereotyping, on the one hand, and the intolerance of ambiguity, on the other. There is a similar affinity between the orientation toward love and acceptance of drive-impulses, on the one hand, and a general flexibility on the other. The struggle between these two orientations is basic to our civilization, its individual members display these two patterns in varying proportions and changing configurations”* (Frenkel-Brunswik, 1949, p. 141).

The research presented in this dissertation speak to Frenkel-Brunswik’s words in multiple ways. From an empirical perspective, indeed we have shown that mental rigidity and intolerance of ambiguity are linked to intergroup hostility, and at the same time that cognitive flexibility is associated with tolerance and acceptance of dissimilar others. From a philosophical and existentialist perspective, acknowledging the essential tension between the rigidity-ideology and flexibility-tolerance dimensions as well as the fact that these are constantly in struggle within the individual and across history should inspire hope. Why hope? Because it is exactly in the plasticity and malleability of these orientations – and the study of their nature – that we can imagine and implement positive change to build more tolerant, loving, and creative societies.

The aim of this research and its subsequent future elaborations is therefore not only to characterize ideological cognition in scientifically-rigorous ways, but also to consider how this knowledge can have tangible consequences for how we understand the contemporary moment and our collective history, how we educate future generations, and how we help those who are most susceptible to the allure of collective ideologies. As new forms of ideologies continue to emerge – including ones with clearly sincere and positive intentions to improve the state of all humanity and the

natural environment – this line of research will need to grapple with the challenging task of investigating radical forms of social justice ideologies, unprecedented types of populism, and the difficulty of conducting political psychology and neuroscience research without political goals or prejudice<sup>17</sup>. Moreover, the findings of the present studies suggest that policymakers and intervention scientists may benefit from incorporating objective cognitive assessments into their toolkits for evaluating individuals' susceptibility to radicalisation and extremism. Hence, an interdisciplinary approach that is biologically-informed and socially-sensitive, and guided by both theoretical considerations and data-driven analytics, will be instrumental in deconstructing the complex cocktail of traits, states, situations, and ecologies that shape an individual's vulnerability to ideological worldviews.

By delving into the remarkable parallels between an individual's idiosyncratic tendencies in processing and responding to information and how they evaluate and internalize ideological arguments, we can illuminate the subtle workings of ideologies as well as of general human perception and cognition. It is in these insights that we can discover antidotes to the effects of ideologies on the human mind and to begin to wonder what a life untinged by ideological doctrines and harsh social categorizations might look like – and whether it is even possible.

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<sup>17</sup> Objectivity and rigour in political psychology are naturally fundamental goals if we are to study ideological cognition in a scientific way. However, it is valuable to keep in mind the observations of the philosopher of science Paul Feyerabend who noted in *Against Method*: "Is it not possible that science as we know it today, or a "search for the truth" in the style of traditional philosophy, will create a monster?... "Is it not possible," asks Kierkegaard, "that my activity as an objective observer of nature will weaken my strength as a human being?" I suspect the answer to many of these questions is affirmative and I believe that a reform of the sciences that makes them more anarchic and more subjective (in Kierkegaard's sense) is urgently needed." (Feyerabend, 1975/1993, p. 154). The study of ideological cognition will therefore need to balance the objectivity of science with the humanity and sensitivity of its subject.



# A

## Appendix

**Figure 6.S1.** Bayes Factor for demographics-only regression models ( $BF_{\text{dem}}$ )

**Figure 6.S2.** Models used in Bayesian Model Averaging.

**Figure 6.S3.** Personality correlates of political conservatism factor.

**Figure 6.S4.** Personality correlates of dogmatism factor.

**Figure 6.S5.** Personality correlates of religiosity factor.

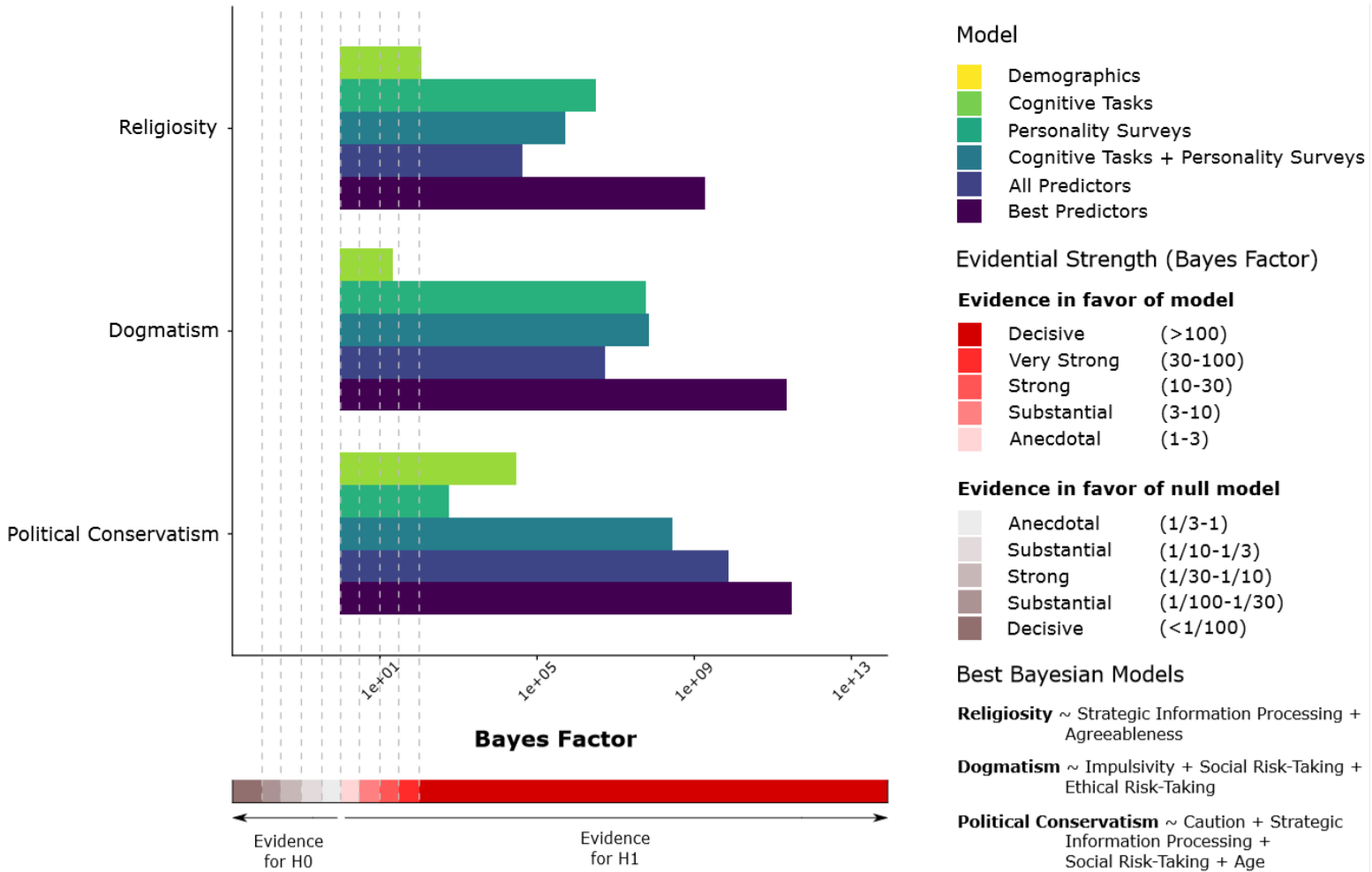
**Figure 6.S6.** Cognitive correlates of dogmatism and religiosity factors.

**Figure 6.S7.** Cross-validated results for ideological orientations.

# Appendix

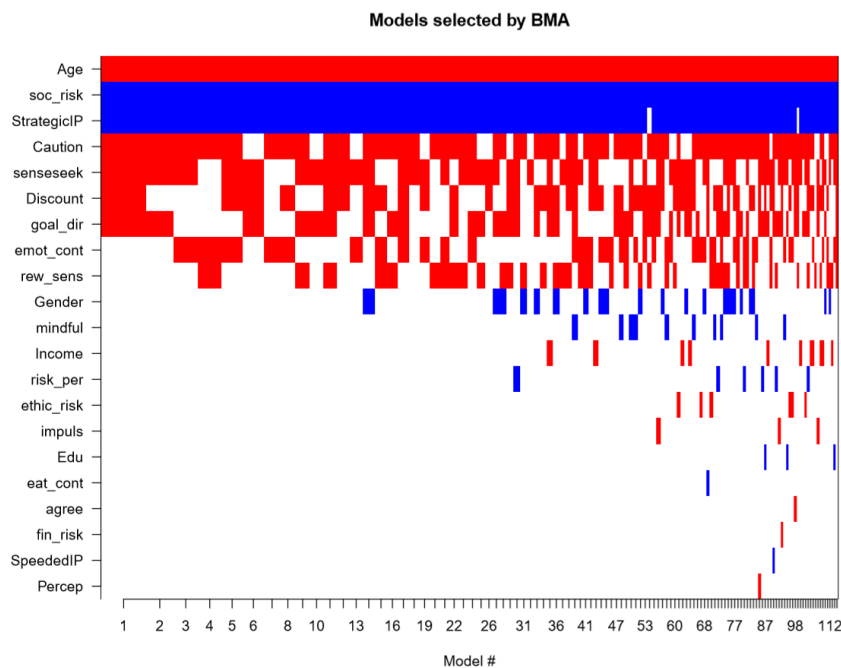
## Additional Figures for Chapter 6

**Figure 6.S1.** Evidential strength (Bayes Factors) of psychological regression models relative to demographics-only regression model ( $BF_{dem}$ ).

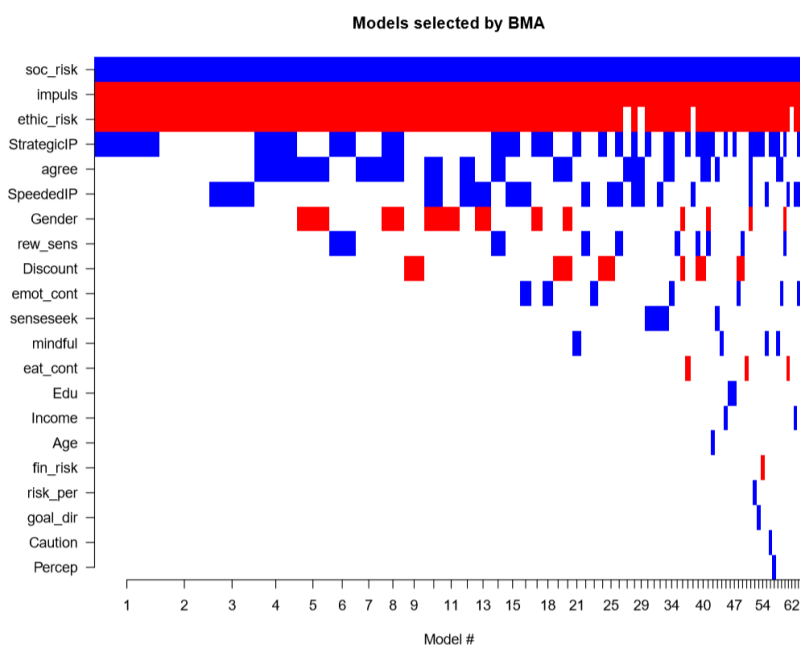


**Figure 6.S2.** Models used in Bayesian Model Averaging of (A) political conservatism, (B) dogmatism, and (C) religiosity. The variables are ordered by probability of inclusion. If a variable is included in the model, red indicates positive estimate while blue indicates negative estimate (white indicates it was not included in the model). The models are ordered by posterior probability from left to right, and bar width reflects the posterior probability of the model. See Figure 6.6 for probability of inclusion of each variable.

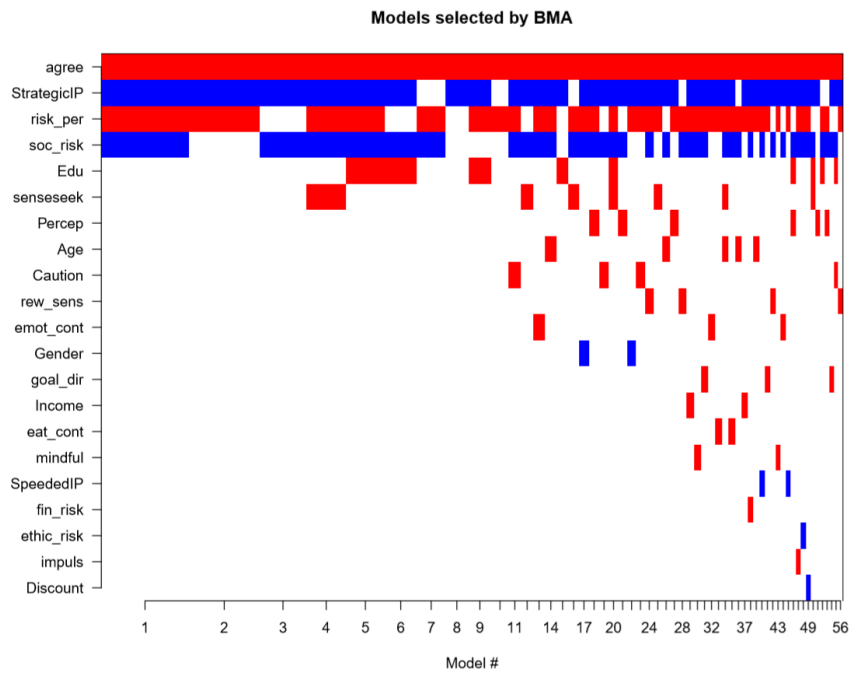
(A) Political Conservatism



(B) Dogmatism

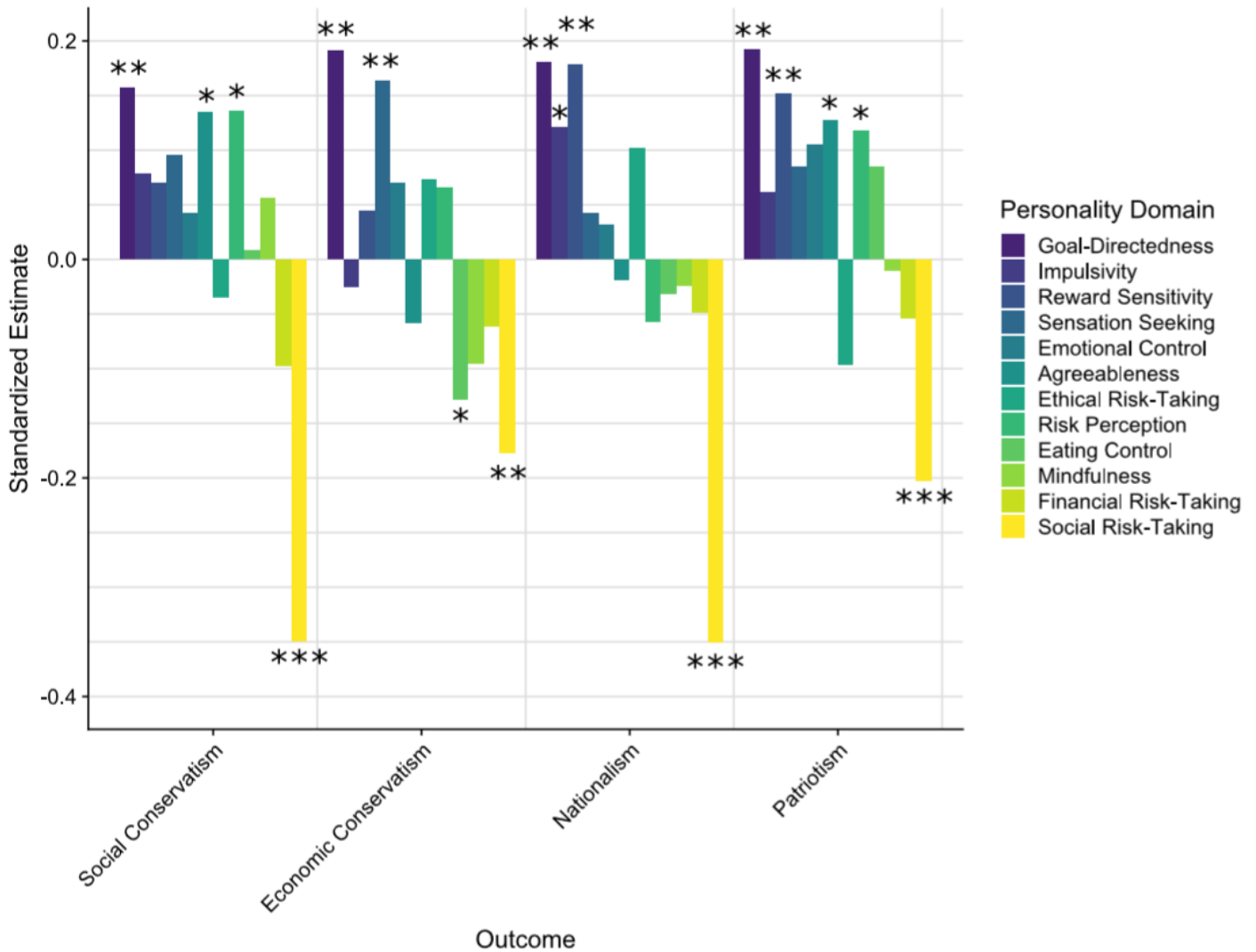


### (C) Religiosity



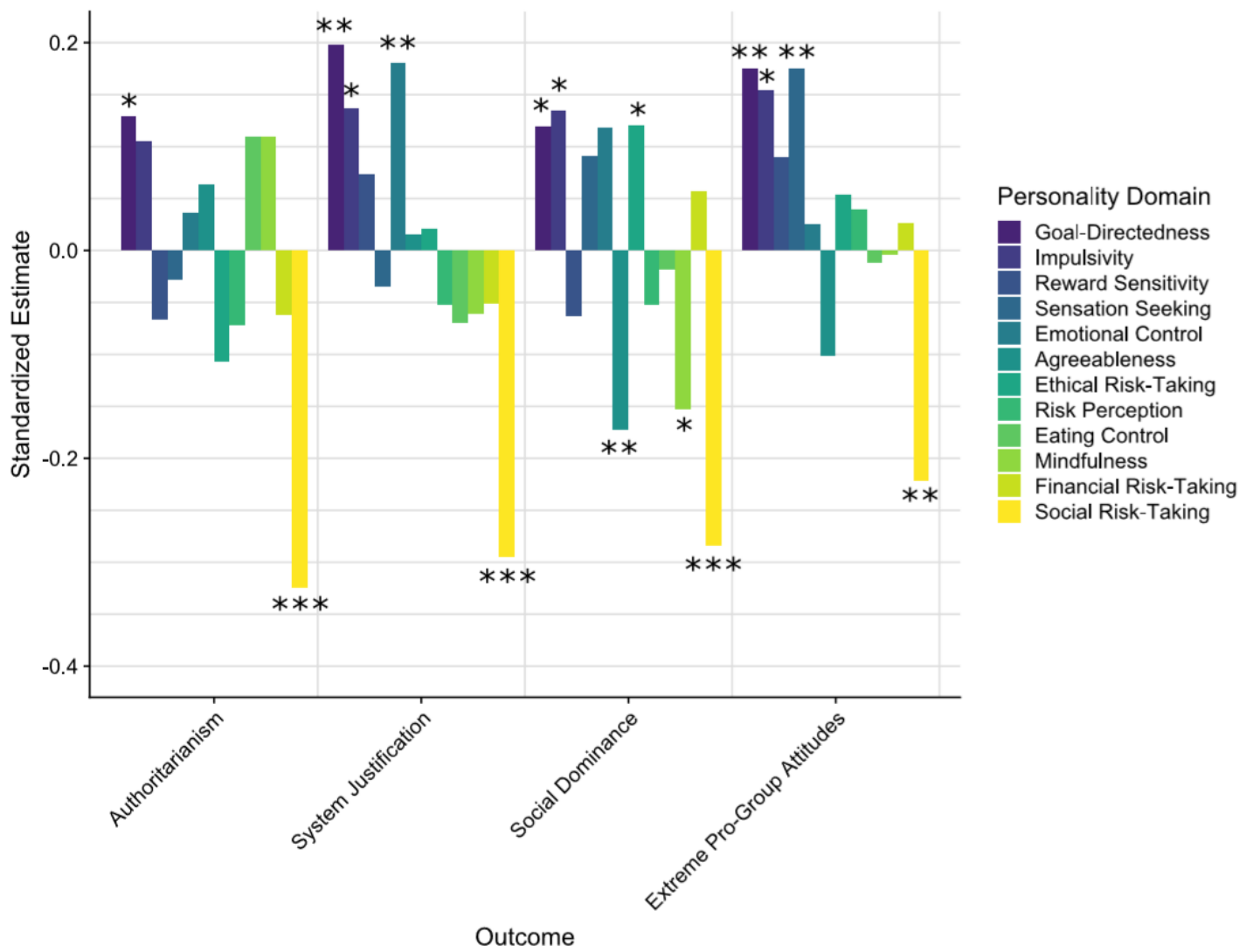
**Figure 6.S3.** Standardized estimates of personality variables for ideological orientations that load on the Political Conservatism factor (divided across S3 A and B). Derived from multiple regression model predicted by personality survey variables only.

(A)

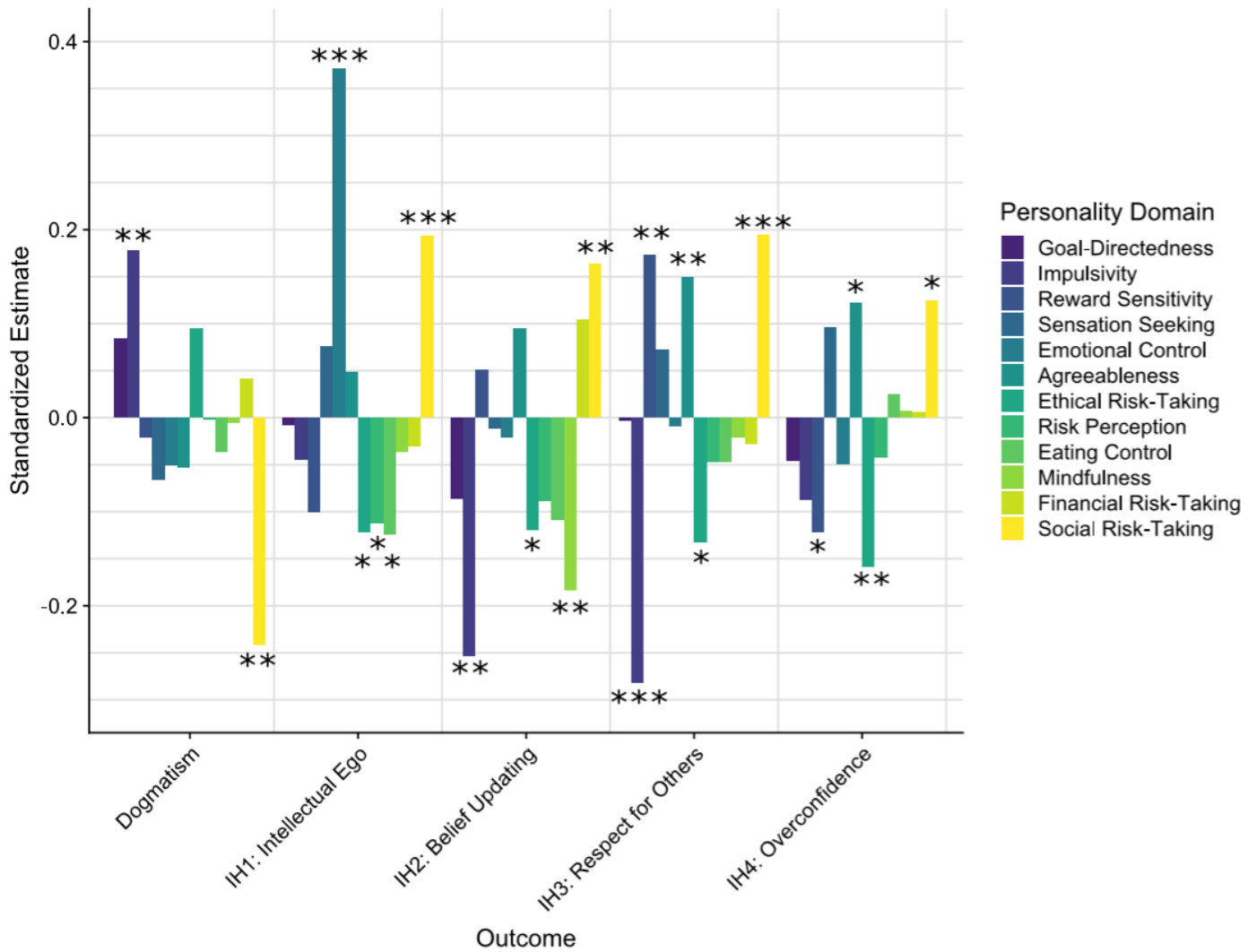




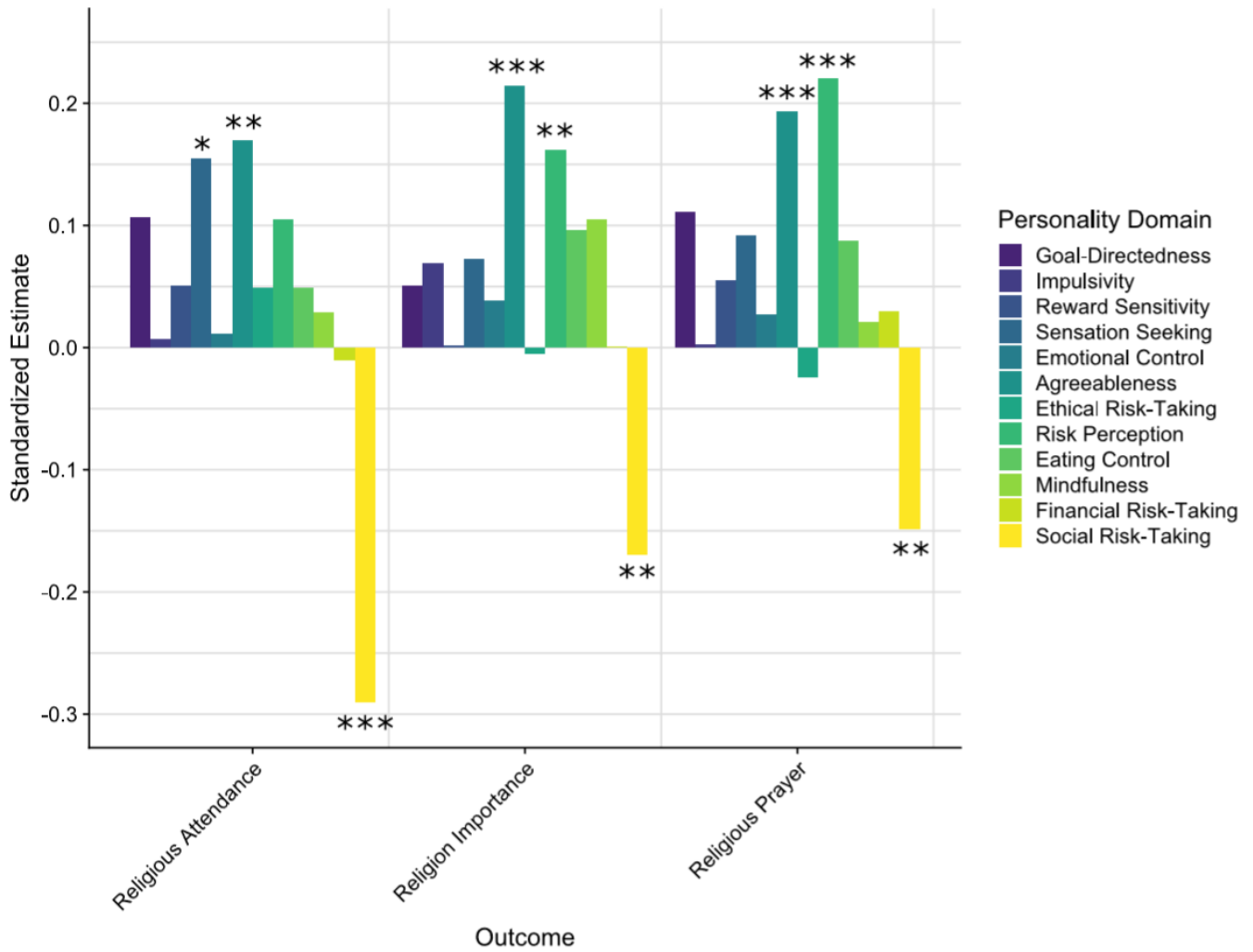
(B)



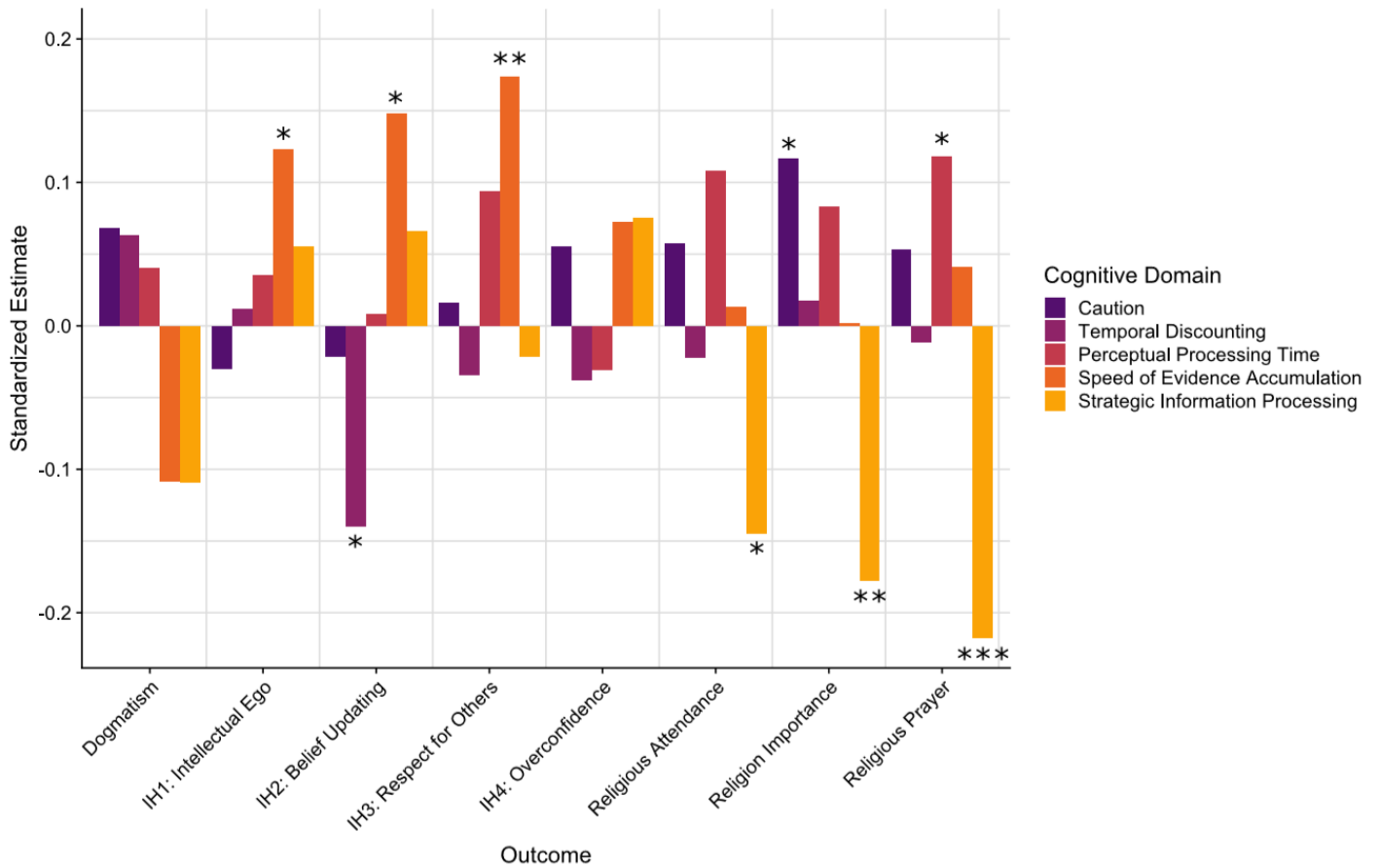
**Figure 6.S4:** Standardized estimates of personality variables for ideological orientations that load on the Dogmatism factor. Derived from multiple regression model predicted by personality survey variables only. IH = Intellectual Humility. IH1 = Independence of Intellect and Ego; IH2 = Openness to Revising One’s Viewpoint; IH3 = Respect for Others’ Viewpoints; IH4 = Lack of Intellectual Overconfidence.



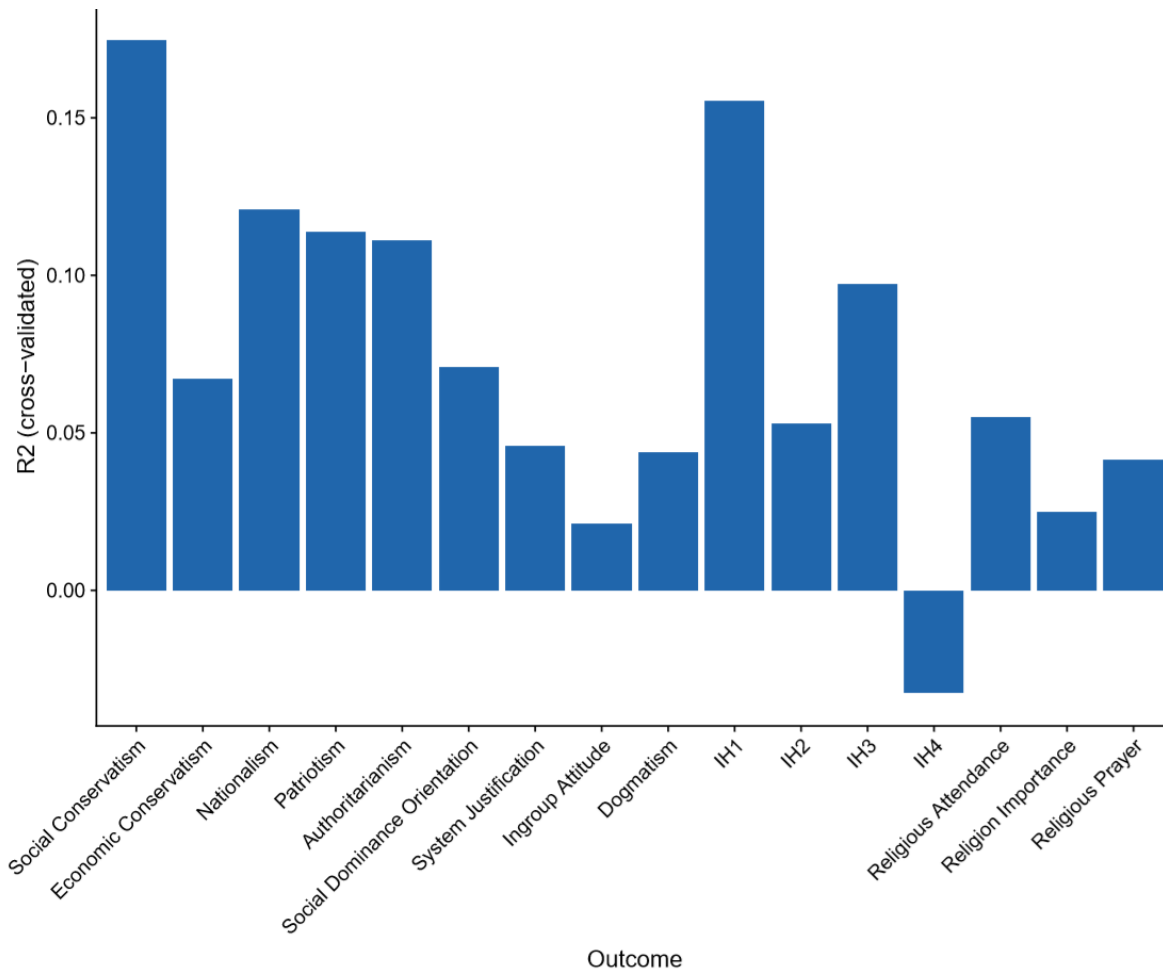
**Figure 6.S5.** Standardized estimates of personality variables for ideological orientations that load on the Religiosity factor. Derived from multiple regression model predicted by personality survey variables only.



**Figure 6.S6.** Standardized estimates of personality variables for ideological orientations that load on the Dogmatism and Religiosity factors. Derived from multiple regression model predicted by cognitive task variables only. IH = Intellectual Humility. IH1 = Independence of Intellect and Ego; IH2 = Openness to Revising Viewpoint; IH3 = Respect for Others' Viewpoints; IH4 = Lack of Intellectual Overconfidence.



**Figure 6.S7.** Cross-validated predictive accuracy for ideological orientations using the psychological variables (cognitive and personality variables). The cross-validated prediction significantly predicts all outcomes, except for the Intellectual Humility (IH) component Lack of Intellectual Overconfidence (IH4). IH1 = Independence of Intellect and Ego; IH2 = Openness to Revising Viewpoint; IH3 = Respect for Others' Viewpoints.





# B

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