

# Choices, Frames & Personal Values

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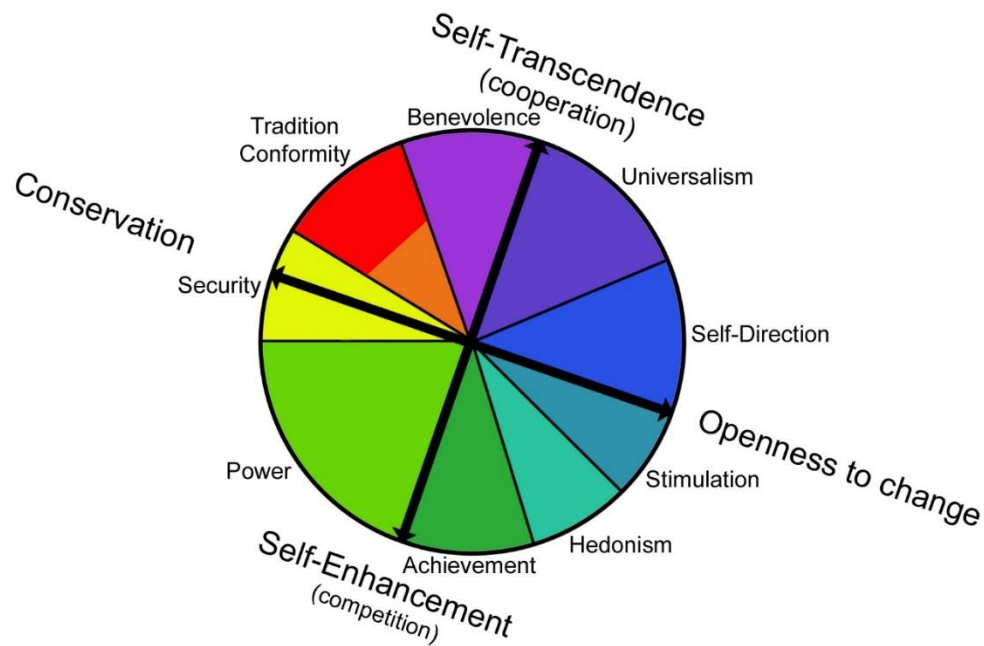
## Abstract

Decision-making is understood to be influenced by genetic and environmental factors related to need, as are personal values. Personal values are a component of personality known to influence decision-making in agreement with the circular structure of the Schwartz (1992) system. We set out to explore whether personal values also exert complementary linear patterns of influence on heuristics and performance in fluid intelligence and creativity tests. Such patterns are predicted by an evolutionary theory that proposes the influence of values described by Schwartz (1992) evolve sequentially and incrementally in living systems, internalising the schema of a pre-existing system of universal equivalents. Testing  $N=1317$  individuals with challenges derived from Kahneman and Tversky and others, we found values exerted both circular and linear influences on intuitive and rational decision-making. These were apparent in overall value/response correlation patterns, and in the performance of individuals allocated to linear, values-based, quasi-Maslowian (1943) motivational types. Performance in fluid intelligence and creativity tests most strongly betrayed linear, developmental patterns of influence. In relation to a Bayesian inference challenge, tentative support was also forthcoming for the hypothesis that those most likely to be subject to values-related conflicts would be most likely to avoid giving erroneous intuitive responses by engaging rational system 2 thinking (Stanovich & West, 2000). This suggests values may also play a role in mediating between rational and irrational systems of thinking. These findings extend our understanding of the role values play in individual decision-making, and by extension, their importance in organizational and societal decision-making.

## **1. Introduction**

People are rarely completely rational in their decision-making and, even when they endeavour to be so, uncertainties arising from complex interactions of environmental variables often contribute to suboptimal outcomes. Individuals make choices influenced by frames of reference and irrational assessments of value based on perceptions of risk (Kahneman & Tversky, 1984). Both are likely to be influenced by past experiences (Juliussen, Karlsson, & Gärling, 2005) and cognitive biases (Stanovich & West, 2008), which, in turn, are subject to genetic factors, including those relating to personality (e.g., Haselton, Nettle, & Andrews, 2015; Paunonen, 2003).

Risk-Sensitivity Theory (RST; Caraco, Martindale, & Whittam, 1980) predicts that decision-makers shift from risk-aversion to risk-preference as need dictates, where need describes the disparity between an individual's present state and desired (or goal) state (Ermer, Cosmides, & Tooby, 2008; Stephens, 1981). An individual's needs are reflected in unconscious and conscious assessments of what is valuable or important to them according to their personal values (Schwartz, 1992). Personal values are abstract beliefs that serve as trans-situational motivational goals that, when activated, elicit emotional responses that guide decision-making (e.g., Arciniega, Stanley, Puga-Méndez, Obregón-Schael, & Politi-Salame, 2019; Bardi & Schwartz, 2003). As such, it is apparent personal values serve as a form of psychological currency in which the relative benefits of disparate concepts may be evaluated and compared on a like for like basis (Brosch & Sander, 2013): translating environmental inputs into emotional outputs recognised as feelings that influence choice. This suggests they are components of system 1 (Stanovich & West, 2000) thinking, based on intuition and instinct, as well as being heritable (Twito & Knafo-Noam, 2020) components of personality (Griffiths, Thomas, Dyer, Rea, & Bardi, 2021; Parks-Leduc, Feldman, & Bardi, 2015).



**Fig. 1** The Schwartz (1992) Values Circle

Schwartz (1992) describes a systematic motivational construct comprising ten values that serve as guiding principles for life, orientated around two orthogonal axes: conservation to openness to change, and self-enhancement to self-transcendence, as shown in fig. 1. Values adjacent to each other tend to serve similar needs and promote similar behaviors, whereas opposite values tend to correlate negatively, both in the behaviors they promote and how they are prioritized by individuals (Bardi & Schwartz, 2003). These behaviors may be related to decision-making with and without obvious, directly values-related components. As an example of the former, in a study exploring the role of values in decisions to buy fair-trade goods, Doran (2009) found that the importance individuals placed on universalism alone accounted for 20% of purchase variation. In that research, the neighbouring value of self-direction also correlated positively, while the opposing values of conformity, security, power, achievement, and hedonism all correlated negatively. As an example of the latter, Kitsawad and Guinard (2014) found that decisions as to which brand of potato chips and orange juice buyers preferred fitted expectations that conservation values would favor familiar brands and saving money, whereas openness to change values promoted a willingness to experiment with other brand attributes.

Given the inextricable relationship between values and affect (Schwartz, 1992), and Zajonc's (1980) consideration that all perceptions are subject to affect, values seem likely to exert an influence on all decision-making via the affect heuristic (Slovic, Finucane, Peters, & MacGregor, 2007). If emotions are evolved responses that encourage behavior likely to increase an organism's chances of survival and reproduction (e.g., Rolls, 2014), in line with Brosch and Sander's (2014) interpretation of Rolls' (2014) theoretical account of the role of emotions in decision-making, values likely play a naturally selected role in assessing the reward and punishment potential of environmental inputs. Given that values are known to be environmentally adaptive (e.g., Daniel, Fortuna, Thrun, Cioban, & Knafo, 2013), and intuitive thinking is subject to both genetic and experiential influences (e.g., Epstein, 2010), it may be that the influence of values on individual decision-making is similarly multi-layered.

Cognitive-experiential self-theory (CEST) (Epstein, 2003) describes a system of personality with an 'experiential' adaptive unconscious component comparable to the intuitive component of dual-system thinking (Sloman, 1996). In CEST, the heuristics associated with experiential thinking are mediated by affect and viewed as components of adaptive processes linked to survival and reproductive needs humans share with other animals; suggesting they evolved prior to distinctively human intelligence and system 2 (Stanovich & West, 2000) rational thinking. In exploring a means to unify theoretical perspectives on decision-making under risk, such as 'rule of thumb' heuristics, the greater weighting of potential losses relative to gains in Prospect Theory (Kahneman & Tversky, 1979), and the needs-sensitive foraging preferences described by RST (Caraco, et al., 1980), Mishra (2014) considers need and motivation to be means by which to extend RST from its animal behavioral roots to humans. In RST decision-making is geared toward satisficing (Simon, 1956), i.e., settling on solutions that are good enough rather than optimal. This is informed by fitness-related survival and reproductive costs and returns associated with actions in stochastic environments.

### **1.1 An Evolutionary Perspective in Personal Values**

Griffiths, Thomas, and Dyer (2021) offer a radical theoretical evolutionary perspective on the origins of human values and their role in decision-making. This considers them in terms of universal schema arising from fundamental physical motivations present in all evolutionary systems. In organisms, these express themselves as need. It proposes that motivational factors equivalent to all ten values may be inferred as operating everywhere in the universal system, and these are incrementally internalised by evolving local systems as they: gain stability, become complex adaptive systems (CAS), and, in the case of humanity, evolve to replicate all ten in sympathy with Deutsch's (2011, p.59) conceit of humans as 'universal constructors' – "factories for transforming anything into anything that the laws of nature allow". The internalisation of this universal system of equivalents in Schwartz's (1992) system of personal values resonates with Simon's (1995, p.26) description of how CAS may evolve to become "sets of boxes nesting within sets of boxes", and Gell-Mann's (1994) description of CAS replicating schema present in the greater systems of which they are part.

Firstly, uniform local systems such as hydrogen atoms emerge and persist in states of energetic equilibrium: so internalising universal equivalents of benevolence (localised conservation of energy being equivalent to Schwartz's (1992) references to in-group cooperation), tradition and conformity (consistency through time and space), and security (regulated behavior with reference to boundaries). Secondly, organisms emerge, internalising a motivation to actively promote competition between systems through the equivalents of power (influence and control over external resources for competitive gain, e.g., metabolism, foraging, predation, immune responses, etc.) and achievement (success in relation to recognized benchmarks, e.g., natural and sexual selection). Thirdly, abilities to instigate change in ways that mimic the chaotic interactions responsible for evolution (e.g., environmental variation and genetic mutation) are internalised for increasingly

targeted, local system specific benefits, giving rise to equivalents of hedonism and stimulation.

Examples of such exploratory mechanisms include that by which cellular cytoskeletons are formed when randomly directed filaments sent out from nuclei form satisfactory connections with cell membranes (Kirschner & Mitchison, 1986), how the tendrils of climbing plants reach for support (Darwin, 1876), and the playfulness and adventurousness of intelligent organisms such as apes (Pellegrini, et al., 2007) and octopi (Zylinski, 2015). Finally, in humanity, the values of self-direction (independent thought and action), universalism (understanding nature), and a form of non-localised benevolence that extends beyond close genetic relatedness or symbiosis, are internalized. These values effectively facilitate humanity becoming a purposeful agent of its own evolution. Universal equivalents to these values are inferred in entropy in the direction of time's arrow, the systematic interaction of information across the universe, and conservation of energy respectively.

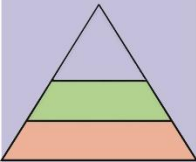
Considered in this light, the structure of Schwartz's (1992) system of values can be considered to represent four stages of broad ancestral strategic development. The conservative values promote stability, continuity, order, and resistance to potentially disruptive forces. The self-enhancing/competitive values facilitate change, insofar as they promote demonstrably successful/fitness-enhancing behaviors over others. The openness to change/progressive values promote risk-taking in what is effectively 'research and development', that becomes increasingly targeted: from hedonism (having fun), through stimulation (seeking novelty and adventure) to self-direction (targeted curiosity, independent thought and action). Finally, the self-transcending values work with self-direction to accelerate knowledge sharing, universal understanding, and innovation through cooperation.

Consistent with their systematic nature, personal values, and the behaviors they promote, are bound to evolve with respect to each other, other systems with which they interact, and the greater

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systems of which they are part. Individuals most motivated by self-direction and the self-transcending values may be responsible for innovations (such as the internal combustion engine and the Internet) that, over time, become progressively attractive to those motivated most by values lower in the hierarchy: firstly, to those seeking fun, novelty, and experimentation (encouraged by openness values); then, to those seeking to use them to gain a competitive advantage (encouraged by self-enhancing values); and finally, when innovations become fully established and broadly accepted, those seeking relative order and stability (encouraged by conservation values). While the evidence of thousands of years of technological and cultural evolution suggests this is the dominant pattern, the reverse is also possible. Those most resistant to change may eschew cultural, scientific, and technological progress, and seek to restore a previous orderly state, e.g., the Amish and Islamic State.

The progressive evolutionary structure described above resonates with Maslow's (1943) hierarchy of needs. As shown in fig.2, comparison between the values Maslow (1987) associated with each level of his hierarchy and those of the Schwartz (1992) system shows broad sequential alignment.

Maslow Need Type	Maslow Values/Qualities	Schwartz Values
<b>Self-Actualization (B-Values)</b> 	Wholeness Perfection (balance and harmony) Completion Justice Simplicity Liveliness (spontaneity) Beauty Goodness (benevolence) Uniqueness (individuality) Playfulness	inner harmony, unity with nature ( <b>universalism</b> ) .. .. , wisdom, world at peace ( <b>universalism</b> ) social justice, equality ( <b>universalism</b> ) honesty ( <b>benevolence</b> ) exciting life ( <b>stimulation</b> ) world of beauty ( <b>universalism</b> ) helpful, forgiving, honest, loyal, etc. ( <b>benevolence</b> ) independence, setting own goals ( <b>self-direction</b> ) creativity, freedom ( <b>self-direction</b> ) enjoying life ( <b>hedonism</b> ) honesty (benevolence) wisdom ( <b>universalism</b> ) independence, setting own goals ( <b>self-direction</b> ) meaning in life ( <b>benevolence</b> ) true friendship ( <b>benevolence</b> ) curiosity ( <b>self-direction</b> ), wisdom ( <b>universalism</b> )
<b>Esteem (D-Values)</b>	Self-Respect Competence Reputation and Appreciation & Recognition Status and Dominance Achievement Mastery	self-respect ( <b>achievement</b> ) capable ( <b>achievement</b> ) preserving public image ( <b>power</b> ), social recognition ( <b>power and achievement</b> ) social power ( <b>power</b> ) <b>achievement</b> success, capable ( <b>achievement</b> )
<b>Love &amp; Belonging (D-Values)</b>	Friendship Belonging	reciprocation of favours ( <b>security</b> ), true friendship ( <b>benevolence</b> ) associated with <b>benevolence, tradition, conformity &amp; security</b>
<b>Safety (D-Values)</b>	Safety Law & Order Security	healthy, clean ( <b>security</b> ) honouring parents & elders ( <b>conformity</b> ), social order ( <b>security</b> ) family security, national security ( <b>security</b> )

**Fig. 2.** Comparison of Maslow's (1987) hierarchy of needs and Schwartz's (1992) values

If Maslow's 'safety' and 'love and belonging' needs are considered as one, their associated values correspond with Schwartz's conservation values and some benevolence values. In placing conservative safety needs below (i.e., to consider them more fundamental than) cooperative love and belonging needs Maslow appears to have failed to recognise the latter as preconditions for safe physiological existence: cooperation between gametes being fundamental to the existence of every human life, and cooperation between family and tribe members being fundamentally important to humanity (Boyd & Richerson, 2009). Maslow's (1987) esteem needs correspond with the values of power and achievement, and his self-actualization needs principally to self-direction, universalism, and the remaining benevolence values. One can also link the hedonism value of 'enjoying life' and the stimulation value of 'exciting life' with Maslow's self-actualizing values of playfulness and liveliness.

The discovery that Maslow's 'higher' needs appear to operate independently of 'lower' needs (e.g., Wahba & Bridwell, 1976), and so their activation is not dependent on the satisfaction of lower needs, is consistent with what might be expected given the heritability of values (Twito & Knafo-Noam, 2020) and the shuffling of genes that takes place in meiosis. So, while one can infer a rational, developmental progression from the effective strategies one might associate with the lowest values (tradition and conformity – 'follow others') to those associated with the highest (self-direction, universalism, and benevolence – 'think and act independently, develop a deep and wide understanding, and share openly and honestly'), individuals may be subject to genetic predispositions for pursuing mixed and potentially inconsistent strategies.

Because values operate as parts of a system, the influence of any one value cannot be fully revealed in the score generated by responses to a questionnaire such as Schwartz, et al.'s (2001) PVQ-40. For



example, self-direction's relationships with independent thought and action are likely mediated by the breadth and depth of knowledge facilitated by universalism and benevolence, and subject to the influence of the opposing values of tradition to achievement. Logically, an individual highly motivated by religious beliefs and customs (tradition), or inclined to copy others (conformity), or to attach great importance to the perceived safety of regulation and boundaries (security), or to maintain the good opinion of, or gain influence over, others (power), or desires the approval and respect of others (achievement) will be restricted in their capacities for independent thought and action relative to others for whom these values are relatively less important. Accordingly, to better understand the relationship between values and decision-making biases, one must account for such systematic relations between values in individual motivational systems. Hence, in this study, we analysed individual motivational systems and categorized them in ways that respect Griffiths, et al.'s (2021) evolutionary theory, Maslow's (1987) hierarchy, and Schwartz's (1992) circle.

### **1.2 Context for this research**

If, as we suggest, values affect all decision-making, not simply the contemplation of dilemmas with clear values-related, moral, and ethical dimensions, it should be possible to detect their influence in other aspects of irrational and rational decision-making. As an exploratory exercise, given a lack of previous research on which to build, we set out to test individuals with a selection of simple challenges of good provenance rather than alternatives specifically designed to reveal values-related biases. For example, most of the propositions chosen to investigate irrational heuristics were derived from Kahneman (2011). These challenges were devised by Daniel Kahneman and Amos Tversky to explore general irrational tendencies, rather than differences in individual biases, or the causes or practical consequences thereof. However, as we hope will be the case with our research, their findings are generalizable in ways that invite consideration of such matters. For example, cultural differences in risk assessment have been identified with national (Bontempo, Bottom &

Weber, 1997) and other cultural dimensions related to individualism and masculinity (Wang, Rieger, & Hens, 2017). Also, the power status of individuals also appears to have an affect (Inesi, 2010), with potential consequences for organizations and societal systems in which such power is wielded.

### **1.3 General theoretical expectations**

If Griffiths, et al.'s (2021) hierarchically developmental and evolutionary interpretation of Schwartz's (1992) values is more than plausible speculation, evidence should be available to demonstrate hierarchical influences on decision-making in addition to those associated with the circle. If the equivalents of conservative values were governing all stable systems before life evolved, and continued to dominate the motivation of organisms when self-enhancing competitive motives related to survival and reproduction were internalised, it seems likely that they were responsible for laying the deepest foundations of our intuitive/system 1/experiential thinking (e.g., Sloman, 1996): those that pre-dated the evolution of intelligence. If equivalents of these values dominate the motivational systems of most animals, it seems likely the conservative and self-enhancing values are most likely to promote behavior and decision-making biases associated with RST: i.e., an aversion to risk that diminishes only when the returns available from safe investments are inadequate to satisfy basic needs. If the self-enhancing values later became differentiated from the conservative values to facilitate fitness-enhancing change, they would seem likely to promote a greater preparedness to take risks when the balance between personal costs and benefits is favourable. In keeping with the exploratory behavior of organisms that may be associated with the universal equivalents of the openness to change values of hedonism and stimulation, these seem likely to encourage a greater preparedness for risk-taking.

The decision-making biases so far described could just as well be attributed to the circular arrangement of the values as to a hierarchical one. It is the roles played by self-direction's

independent thought and action, universalism's wisdom, and a rational, universalist approach to benevolence, that potentiate the possibility of discovering a hierarchical influence. These values would appear to be uniquely associated with the type of intelligence associated with rational/system 2 thinking (Stanovich & West, 2000) and creativity. Considered as part of an evolutionary hierarchy, these values potentiate improvements in decision-making over those previously available to organisms without such complex or adaptive neurological systems. Once established they have the potential to work with pre-existing values, potentiating improvements in the decision-making facilitated by them. They may increase opportunities for and inform the risk taking associated with hedonism- and stimulation-related drives for fun and adventure. In turn, as novel approaches and behaviors prove their worth, they increase opportunities for self-enhancement, which may in turn lead to their more widespread adoption, and eventually to their becoming conventional and traditional. Because not all novel approaches and behaviors will become known or available to all, or prove their worth, or become established as norms, fewer of them will become potentially attractive options for individuals motivated most by values further down the hierarchy. Accordingly, the demands on neurological processing associated with these values should diminish with each step down the hierarchy. However, as the pace of scientific progress, technological and cultural change increases, so will the number of possibilities that decision-makers have to contend with. Therefore, it seems likely that even the neurological functioning associated with the conservative values will be subject to selection pressure associated with improved decision-making, intelligence and creativity.

Because patterns of effortful thought may, through repetition, be delegated to intuitive thinking in line with the brain's drive toward greater efficiency (e.g., Clegg, Digirolamo, & Keele, 1998), their influence may have observable effects on heuristics as well as on intelligent and creative decision-making. In line with Maslow's (1943) belief that self-actualizing individuals are more at ease - not having to devote so much of their energies to satisfying their more basic needs - it is possible they

will be instinctively among the least risk-averse. But also, if their motivation for material gain (more usually associated with power and achievement) is less, this may make them less interested in this type of risk-taking. Unlike the more generalised motivation for experimentation and risk-taking associated with hedonism and stimulation, self-actualizing individuals seem more likely to adopt investment strategies that promote risk taking when in pursuit of creative or self-transcending goals.

If values are inextricably linked to affect (Schwartz, 1992) and influence most decision-making through the affect heuristic (Slovic, Finucane, Peters, & MacGregor, 2007; see also Zajonc, 1980), and differences in the relative importance individuals attach to values correspond to different intuitive judgements, such as the discount function (see Frederick, Loewenstein, & O'Donoghue, 2002) applied to potential future gains and losses, one is invited to consider what happens when no one set of values is more important than any other. People subject to values conflicts, whose most important values oppose and counteract each other, seem likely to be prone to mixed feelings that cannot easily be resolved in an intuitively satisfactory decision. As such, they seem less likely to exhibit consistent intuitive decision-making biases, and so may be more likely to resolve intuitive dilemmas through rational analysis. Deciding whether to defer gratification has been associated with increased neural activity in the pre-frontal cortex, which is itself associated with rational thought (Casey, et al., 2011; McClure, Laibson, Loewenstein, & Cohen, 2004). Accordingly, if, for example, a deferred gratification proposition was to elicit values-driven, intuitive, and irrational responses, it may be individuals subject to values conflicts may respond differently to and more rationally than others.

Many factors, such as status (Samuelson & Allison, 1994) and age (Besedes, Deck, Sarangi, & Shor, 2012), have the potential to play moderating roles that may obscure the influence of values. Also, for some propositions, when the disparity between the effective values of possible responses

exceeds a certain threshold, the riskiness/attractiveness of one option would be so great as to be rejected/accepted by all individuals regardless of their personal values: who would choose the certainty of receiving one cent in preference to a fair coin tossed opportunity to win \$100,000 on heads or lose one cent on tails? However, beneath this threshold, and regardless of moderating factors, it seems likely that values will have a discernible influence.

#### **1.4 This research and theoretical expectations for its findings**

We tested a large group of individuals with the questions described in section 2.3. Q1 to Q5 were adapted from Kahneman (2011). Q6 is a Bayesian inference challenge adapted from Paulos (1988). Q7 comprises 10 fluid intelligence tests, and Q8 a Guilford's (1967) Alternative Uses Test (GAUT) of creativity. While no detailed hypotheses were pre-registered, these may be inferred in the evolutionary theory of Griffiths, et al. (2021), which itself is based on Griffiths (2013).

- 1) Patterns of value/response correlations will be consistent with both the established circular and proposed hierarchical structures of the Schwartz (1992) system of values.
- 2) Those individuals for whom the conservative values are the most important are likely to be the most risk averse, and the least intelligent and creative, and so are likely to score lower than others in respect of all the challenges presented.
- 3) Those for whom the self-enhancing values are the most important will be the next most risk averse and next least creative, but being the most motivated by personal gain, will be the most likely to pursue gains when potential losses, relative to potential gains, are small (particularly relevant to Q1 and Q4 – the propositions of Q2 and Q3 being more ambiguous).
- 4) Those for whom the progressive values of hedonism and stimulation are the most important are likely to be the least risk averse (particularly relevant to Q1, Q2 and Q4).
- 5) Those for whom the self-actualizing and -transcending values are the most important, will be the least sensitive to potential losses, the most likely to prioritise the interests of others, the

most intelligent, the most likely to give 'improved', rationally supportable intuitive responses, and be the most creative problem solvers (relevant to all challenges).

- 6) Those most likely to be subject to values-conflicts – i.e., those without a dominant value or suite of sympathetic values – will be the most likely to respond rationally when propositions appear to elicit irrational values-driven responses (relevant to Q1 to Q6).

## **2. Method**

### **2.1 Procedure**

Approval was granted by the ethical committees of Royal Holloway University of London (Phases 1 & 2) and Bournemouth University (Phase 3). Through a combination of personal invitations sent to organizations and advertisements placed on psychological research platforms (Psychological Research on the Net and Social Psychology Network) and at Bournemouth University psychology department, participants were recruited to complete online questionnaires in which they were presented with a values-related questionnaire followed by a series of decision-making challenges. No financial inducements were involved. Some participating students received psychology course credits and all participants were offered a free personal values profile based on their responses accompanied by interpretative guidance notes.

Data was collected in three phases from 2014 to 2021. The same values questions were presented in all cases, but the decision-making challenges were modified between phases. From 1588 responses, after the pre-planned removal of data from: (1) 116 individuals declaring that English was neither their first language nor a language in which they had acquired naturalized proficiency, (2) 13 multiple entries from the same participants, and (3) 142 individuals who repeated the same answer

to a previous values question for a total of 12 times or more, including a sequential run of 5 or more.<sup>1</sup>, a total of 1317 individual responses remained to be analysed.<sup>2</sup>

## 2.2 Participants

Phase 1 involved 189 professional employees of commercial and not for profit organizations with an age range from 22 to 67<sup>3</sup> ( $M = 44.6$ ,  $SD = 10.4$ ). Phase 2 involved 182 professionals from commercial organizations, all but 17 being from a large engineering organization. Of those six whose ages were recorded the age range was 24 to 58 years ( $M = 35.2$ ,  $SD = 12.0$ ), the remainder were mainly drawn from a group of 'high achievement potential' employees whose individual ages were not recorded but were known to be between 25 and 40 years old. In phases 1 and 2, 304 participants were recorded as British, 31 as North Americans, 24 as North Europeans, and 8 as South-East Asians. The remainder's nationalities were unrecorded. Phase 3 involved 945 respondents aged between 14 and 79 years ( $M = 25.0$ ,  $SD = 10.5$ ). Of these 551 were North American, 156 were British, 50 were Asian, and the remainder were Other European, Australasian, African, and Other. The educational levels of participants were not recorded but professional participants were mostly educated to degree level, and most of those responding to the advertisements of psychological research platforms gave email addresses that suggested they were involved in higher education.

## 2.3 Materials

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<sup>1</sup> While it is not possible to determine whether individual responses accurately reflect an individuals' values, given these questions are not presented in groups relating to sympathetic values, frequent repetition of responses suggests an individual's true value priorities are not being represented. The 142 deletions appeared to reduce statistical noise and increase value-decision correlations.

<sup>2</sup> Data and supplementary materials are available from <https://osf.io/v7qdb/files/>

<sup>3</sup> Across the whole sample, 222 individuals provided either no or a false birth date. Age-related statistics were calculated after removing all voids and ages below 14 years and above 99 years.

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Values data was collected with a 40-item, gender neutral, multiple-choice Schwartz Portrait Values Inventory questionnaire (PVQ-40; Schwartz et al., 2001) in which participants were asked to state the degree to which they associated themselves with the types of people being described (e.g., “They like surprises. It is important to them to have an exciting life”) on a Likert scale (1 = not at all like me; 6 = very much like me).

The decision-making challenges presented in the various phases were as follows:

Q1. Deferred gratification – two versions

- i. What would you prefer, £5,200 today or £5,600 next week? – Phase 1
- ii. What would you prefer, £5,200 today or £5,500 in a month from today? – Phase 3

Q2. Assuming you trust the other party to pay up if you won, would you take this bet: toss a coin - heads you lose £100 and tails you win £200? Yes or No (all phases)

Q3. You are responsible for spending a limited healthcare budget on one of two new medicines available to combat a life-threatening epidemic that could affect 1 million people and have to make an immediate decision on which one to use. They have the following curative properties: Medicine A will cure 30% of those infected; Medicine B has a 45% likelihood of curing all those infected and a 55% likelihood of curing none of those infected. Assuming these percentages are accurate, which do you choose? (all phases)

Q4. You are faced with making the following choices together.

- a. Firstly, choose between being given: £240 for certain, or a 25% chance to gain £1,000 and a 75% chance of gaining nothing?
- b. and then, taking a £750 loss for certain, or a 25% chance to lose nothing and a 75% of losing £1,000? (all phases)



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- Q5. If it takes 10 combine harvesters 10 minutes to harvest 10 hectares of wheat, how long would it take 20 combine harvesters to harvest 20 hectares? Options: 5, 10, 15 or 20 minutes. (Phases 1 & 3)
- Q6. Bayesian inference challenge – two versions
- i. There is a potentially fatal bacterial infection known to be affecting 1% of the population. You are asked to attend a local clinic to be tested for infection as part of a national screening process. The test is 99% accurate. After testing you receive a letter from the clinic saying you have tested positively for infection and asking you to come back for further examination. What is the likelihood you have this bacterial infection? Open numerical answer: 0 – 100% (Phases 1 & 2)
  - ii. 90% of the people in a remote mountain village are 'Blutos' and 10% are 'Rimini'. A witness to a night crime in the village reports that the perpetrator was a Rimini. It is known that people such as this witness can distinguish between Blutos and Rimini with 90% accuracy in similar conditions. What is the likelihood the witness got it right, and the criminal is a Rimini? Options: 10%, 50% or 90%. (Phase 3)
- Q7. Fluid intelligence. Participants were sequentially presented with a maximum of ten puzzles (see Figure SM1- including eight Raven's Progression Matrices (RPM)(Raven, Raven, & Court, 1998)) to be completed within a timer-controlled ten-minute window. (Phase 1)
- Q8. GAUT (Guilford, 1967) - "How many uses can you think of for an empty plastic lemonade bottle?" To be completed in a timer-controlled in two-minute window. (Phase 1)

Except for Q6(i) and Q8, participants had to choose between two and six options. Q7 was primarily intended to investigate values-related biases in fluid intelligence, but also to control for the influence of intelligence on answering the other decision-making challenges. Q7 was removed after Phase 1 to reduce the time demands on potential participants and thereby encourage greater

participation, as were Q1, Q5 and Q8. Q1 and Q5 were reintroduced in Phase 3: Q1 in an amended form intended to elicit a greater variance in responses. In Phase 3, a different Bayesian inference challenge replaced the previous version - the aim being to improve the percentage of correct answers.

## **2.4 Analysis**

The average score of responses for each of the ten values was calculated for each respondent. These were used to calculate basic Pearson's correlations with respect to the decision-making challenges. These base figures were attenuated to compensate for the low internal reliability of values - a consequence of their being part of a continuum (Schwartz, 1992) – by dividing them by the square root of Cronbach  $\alpha$  figure for each value<sup>4</sup> (Spearman, 1904).

Given it is the relative importance of an individual's values within their motivational system that influences decision-making, generalized correlations between values scores and performance are of limited use. When considered collectively, correlations may reveal patterns of influence, because value scores and personal rankings are correlated, however, unaccounted for differences in ranking and relationships between values in individual motivational systems reduce the importance of isolated individual scores.

To better investigate the systematic influence of values, in accordance with Boer and Fischer's (2013, pp 1123) assertion that "what is important is the alignment with theoretically derived correlation patterns and such an alignment can be achieved independent of absolute correlation strength", we subjected value/performance correlations to shape-consistency analysis. Anticipating that values

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<sup>4</sup> See supplementary materials table SM1

may exert influences consistent with the circular relationships described by the Schwartz (1992) system, and with the linear hierarchical relationship proposed by Griffiths et al. (2021), we used Procrustes analysis to find the greatest correlation between theoretically idealised transformations of sinusoidal (circular transformed to linear) shapes. This involved altering the phase, amplitude, and tilt of the midline of a single cycle of a sine wave to correspond with a single cycle of Schwartz's (1992) circle (as depicted in fig.3<sup>5</sup>) for each of the value/response correlation patterns.

As per Boer and Fischer (2013), correlations between an idealised waveform and experimental findings were calculated with respect to differences in the sum of the squares of two sets of ten y-values corresponding to ten evenly distributed x-values corresponding to each of Schwartz's (1992) personal values (as they appear in fig.3). While such a distribution of values is sometimes depicted (e.g., Lee, et al. 2019), it does not accurately reflect the relationships between values (e.g., Schwartz & Boehnke, 2004). While the relationship between values and the two axes shown in fig.1 is well established and broadly stable, the precise location of boundaries between values may vary between studies (Schwartz, 1994). Rather than attempt to more accurately reflect this, in interpreting the results we adopted Boer and Fischer's (2013) +.3 curve ambiguity adjustment of Cohen's (1992) consistency ratings. Boer and Fischer (2013) did so to compensate for a .3 correlation between two sine waves out of phase by 90°. We deemed this an adequate allowance for the potential for value boundaries to shift within a quadrant of the circle, and so alter the precise placement of values along a sinusoidal waveform. Accordingly,  $r = .5$  (not .2) was considered to indicate medium value consistency, and  $r = .8$  (not .5) a large value consistency.

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<sup>5</sup> We also adjusted the vertical displacement of the midline to maximise visual alignment, though this had no effect on the correlation.

To investigate the effects of systematic relationships between values more directly, we also analysed the decision-making of differently motivated individuals. In the absence of either a widely accepted methodology or typology that fits with an evolutionary, quasi-Maslowian interpretation of Schwartz's (1992) system, we adapted that of Dominant Needs Analysis (DNA; Griffiths, 2013). This allocates individuals to one of five motivational types, dependent on which is the central value of their dominant (i.e., most important) triad of neighbouring values (as illustrated in fig.3). Given the ten values are abstract divisions of a continuum, rather than being discrete (Schwartz, 1992), the use of higher order value triads is consistent with established theory and empirical precedent, such as when using the higher order values of self-transcendence, openness, self-enhancement, and conservation (e.g., Boer and Fischer, 2013). Three DNA motivational types fit the Maslowian hierarchy as illustrated in fig.2: the conservation values associated with love, belonging and security needs being most important to 'Shepherds'; self-enhancing values associated with esteem needs being most important to 'Hunters'; and self-actualizing/transcending needs and values to 'Philosophers'. A fourth hierarchical type, 'Explorers', located between Hunters and Philosophers as per the evolutionary hierarchy proposed by Griffiths, et al. (2021), describes those for whom hedonism and stimulation (values relatively under-represented in Maslow's hierarchy) are the most important.



**Fig.3** Allocation of values to DNA motivational types by the middle value of dominant triads (for example, an individual who's dominant (highest scoring) triad of values comprises achievement, hedonism, and stimulation would be allocated to the Explorer type)

To generate personal values profiles amenable to analysis and cross referencing we followed instructions from Schwartz (2004). Standard scores were calculated for each value with reference to a norm group comprising 11,967 west Europeans from 12 western European nations, taken from the 2014 European Social Survey with an age range of 14 to 99 ( $M=43.1$ ,  $SD=17.5$ ). Standard scores were converted so that the lowest and highest could be represented within a 0-100% scale.

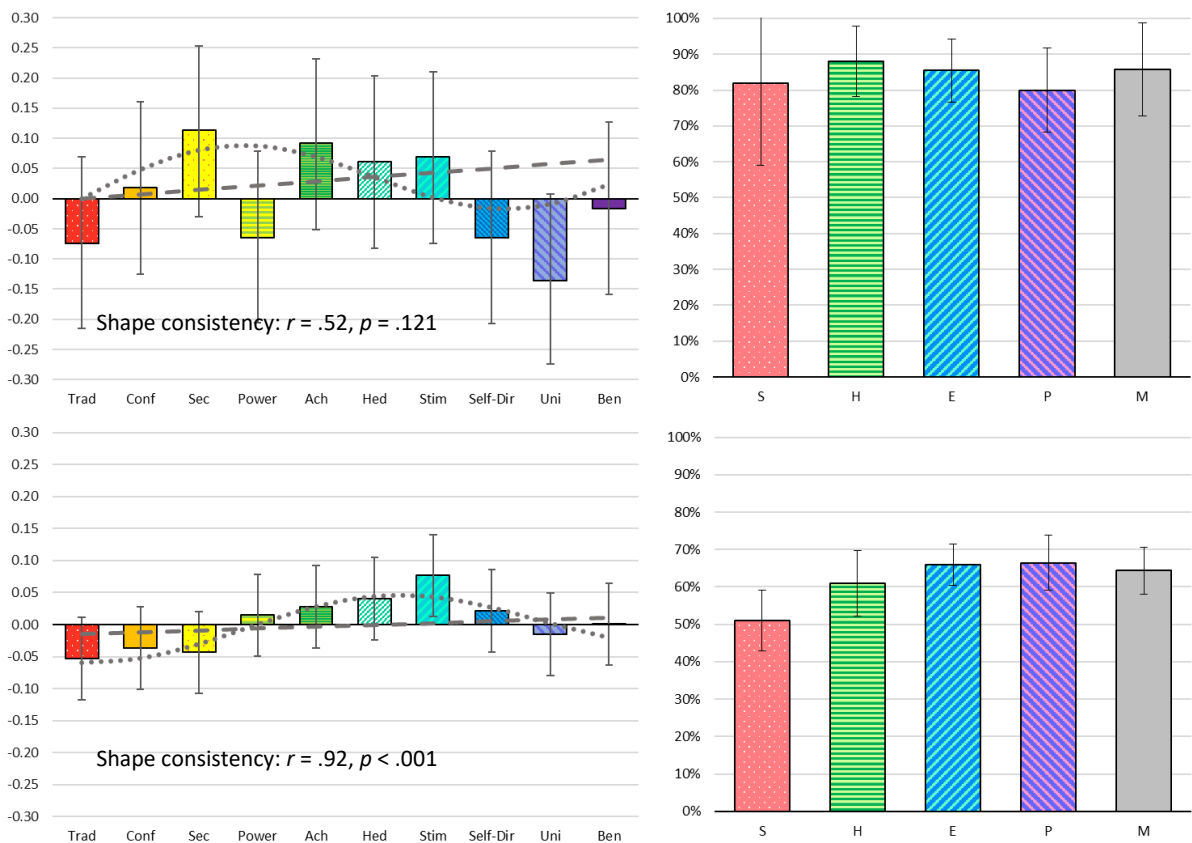
The average standard scores for values in each of the ten triads were calculated for each participant. Individuals were initially allocated to one of the four hierarchical motivational types according to the location of the middle value of their highest scoring (i.e., dominant) triad (see fig.3). To better facilitate a linear, evolutionary, hierarchical and Maslowian interpretation, individuals whose dominant triad was centered on benevolence were allocated to either the Shepherd type, if they scored conformity higher than self-direction, or the Philosopher type, if the reverse was true.

To evaluate the decision-making biases of individuals most likely to be subject to motivational conflicts, i.e., those for which no one triad, or wider set of sympathetic values, dominated others, a fifth motivational type labelled Moderators was used. All those whose dominant triad failed to outscore the next highest scoring and potentially conflicting triad by more than 6% were allocated to this type. Potentially conflicting triads were taken to be those sharing no common values. For this purpose alone, benevolence was treated as if it comprised two values: one associated more with tradition and conformity, the other with universalism and self-direction.

The choice of the 6% threshold was arbitrary but informed by a desire to set it high enough to include a similar number of individuals to the other four types, but low enough to exclude individuals unlikely to experience conflicts between dominant suites of values. The composition of the analysed sample in terms of motivational types was as follows: Shepherds:  $n = 184$ , Hunters:  $n = 212$ , Explorers:  $n = 409$ , Philosophers:  $n = 219$ , Moderators:  $n = 293$ . Average value profiles of each type are shown in the supplementary materials (Figure SM2).

Point biserial (Pearson) correlations between individuals' ten value scores and decisions were calculated for each of the decision-making challenges and Spearman (1904) adjustments for attenuation made. The relative performance of the motivational types was also analysed to provide Chi-Squared statistics for Q1 to Q7 and t-tests for Q8.

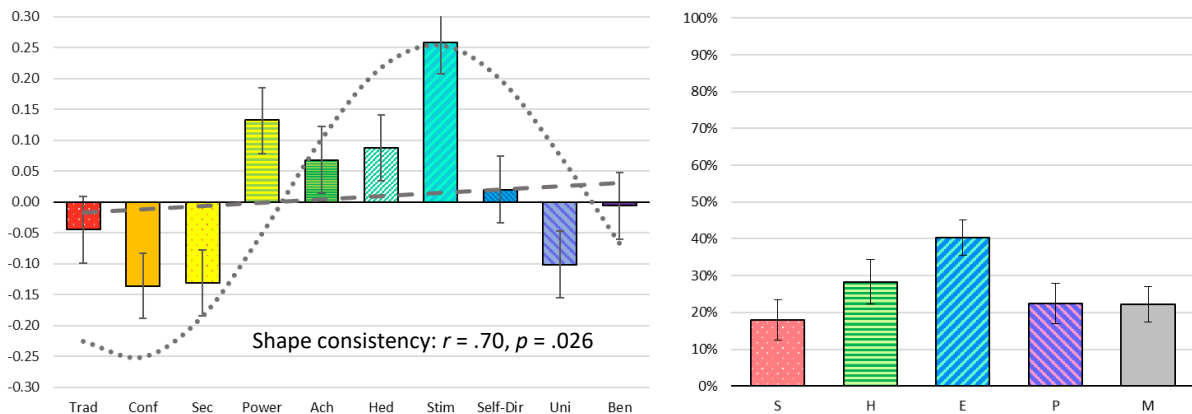
### 3. Results



**Fig. 4.** Q1: Delayed Gratification – Values correlations (left) and motivational type preferences (right) for (i) £5,600 next week,  $N=188$  (above) and (ii) £5,500 in a month's time,  $N=931$  (below) to £5,200 today. In all figures: S = Shepherds, H = Hunters, E = Explorers, P = Philosophers, and M = Moderators. Transformed sine wave and its linear component shown in broken lines. 95% confidence intervals shown.

The only significant correlation between any single value and responses to either version of Q1 was in respect of stimulation in Q1(ii),  $r(931) = .08, p = .018$ . However, as shown in fig.4, a large systematic sinusoidal value-response correlation with a linear component was apparent in respect of Q1(ii),  $r(10) = .92, p < .001$ . For Q1(i), 80-89% of all participants preferred to wait a week for £5,600, rather than take £5,200 today (i.e., applied a discount rate of less than 371% pa), with no significant difference between the motivational types. All types were less willing to wait a month for the smaller reward of £5,500. Relative enthusiasm to wait (and apply a discount rate of less than 65%

pa) decreased in a hierarchal order from Philosophers, through Explorers and Hunters, to Shepherds: dropping from Q1(i) by 14%, 20%, 27% and 31% respectively. Only 51% of  $N=147$  conservative Shepherds now preferred to wait, compared to 67% of  $N=155$  Philosophers:  $\chi^2 = 7.42$ , 95% CI=0.26-0.04,  $p = .006$ .

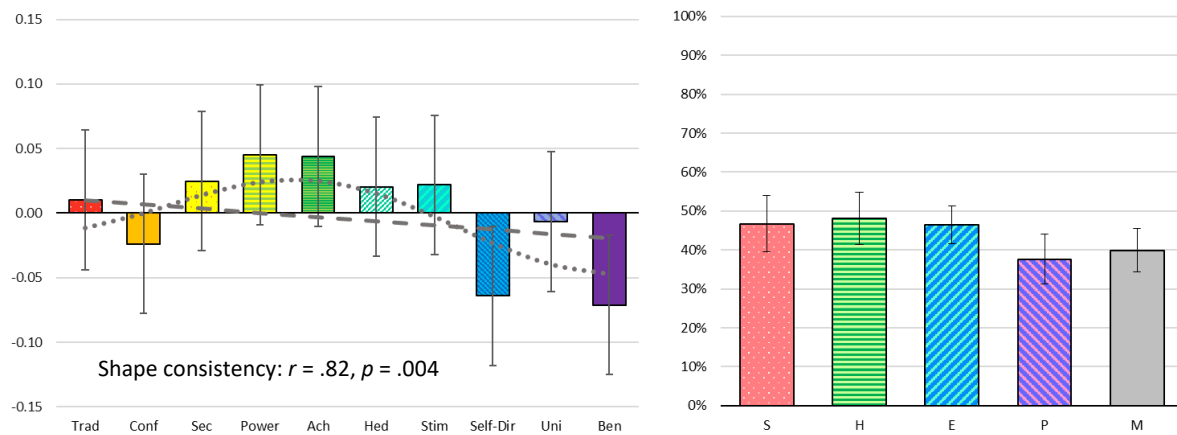


**Fig. 5. Q2: Coin Toss – Values correlations and motivational type preferences for accepting chance of £200 gain at risk of £100 loss,  $N=1316$ .**

As shown in fig. 5, a medium to large value consistent sinusoidal pattern of correlations,  $r(10) = .70$ ,  $p = .026$ , emerged in respect of Q2. There were significant correlations in respect of seven of the ten values: the largest positive correlation being for stimulation,  $r(1316) = .26$ ,  $p < .001$ , with a preparedness to risk losing £100 for the possibility of gaining £200 on the toss of a coin, and the largest negative correlation being for conformity,  $r(1316) = -.14$ ,  $p < .001$ . This translated to 40% of Explorers being prepared to accept this bet compared to 18% of Shepherds,  $\chi^2 = 28.64$ , 95% CI = 0.30-0.15,  $p < .001$ . In keeping with the circular relationships between values, the preferences of Hunters and Philosophers lay between these extremes at 28% and 22% respectively. 22% of Moderators were prepared to accept the bet.



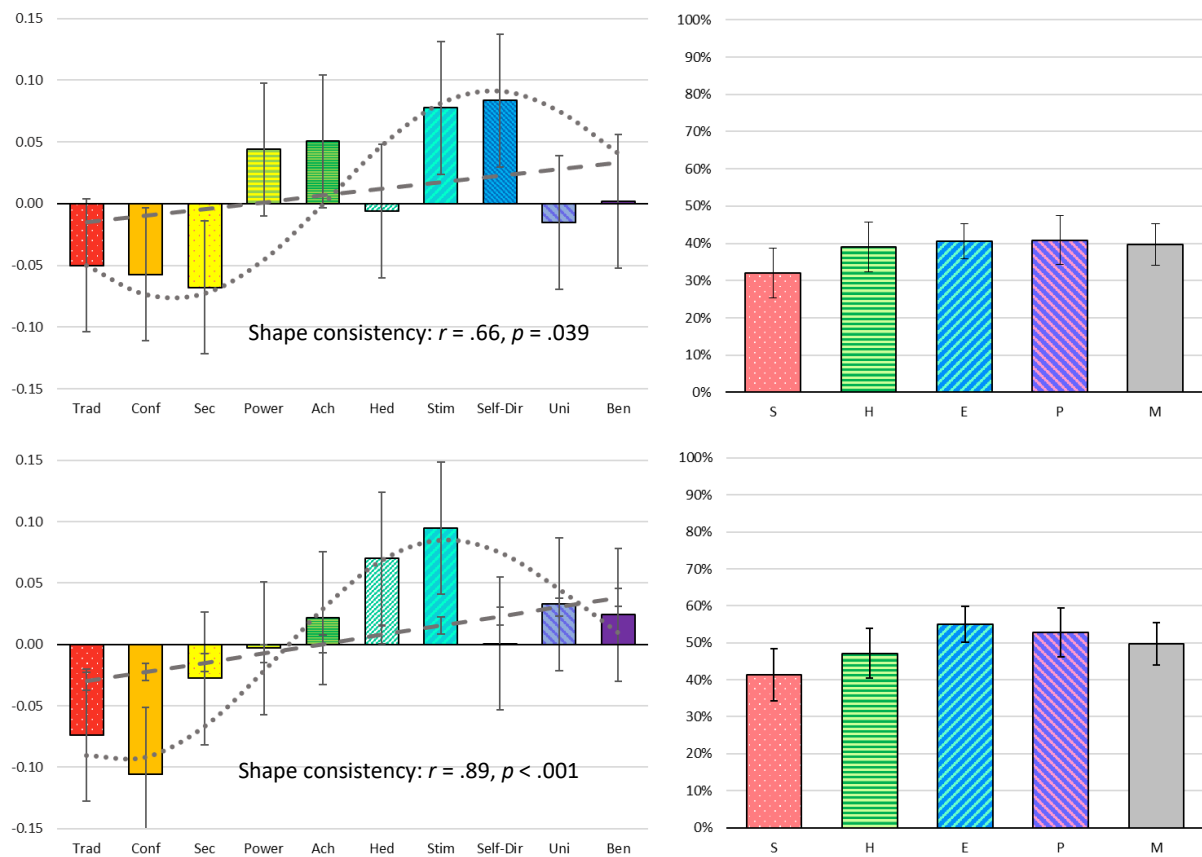
## Choices, Frames & Personal Values



**Fig. 6.** Q3: Healthcare Budget – Values correlations and motivational type preferences for a 45% chance of saving all over the certainty of saving 30%,  $N=1314$ .

Fig. 6 shows the large value consistency,  $r(10) = .82, p = .004$ , between the theoretical combination of linear and sinusoidal patterns of correlations and those of the ten values with whether to invest a healthcare budget in a treatment that will save 30% of lives, or in one that has a 45% chance of saving everyone. Only the individual correlations for benevolence,  $r(1314) = -.07, p = .009$ , and self-direction,  $r(1314) = -.06, p = .020$ , were significant. 48% of  $N=210$  Hunters and 47% of  $N=409$  Explorers preferred a 45% chance of saving all, compared to just 38% of  $N=218$  Philosophers: differences of  $\chi^2=4.80, 95\% \text{ CI} = 0.20-0.01, p = .029$ , and  $\chi^2=4.52, 95\% \text{ CI} = 0.17-0.01, p = .033$ , respectively.

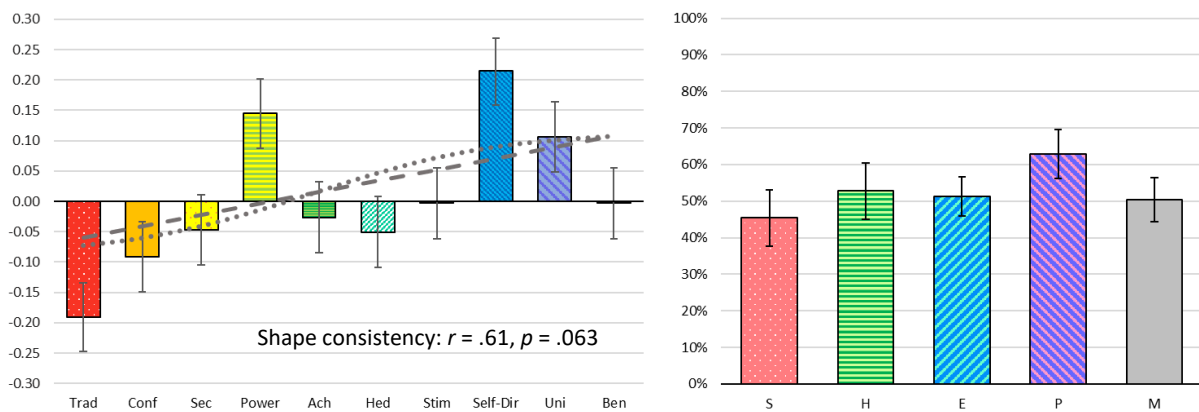
## Choices, Frames & Personal Values



**Fig. 7.** Values correlations and motivational type preferences for Q4: (a) a 25% chance to gain £1,000 and a 75% chance of gaining nothing over £240 for certain, (above), and (b) then, a £25% chance to lose nothing and a 75% of losing £1,000 rather than taking a £750 loss for certain (below)  $N=1313$ .

As illustrated in fig. 7, in respect of both parts of Q4, tilted sinusoidal patterns of correlations of medium to large value consistency were apparent: for Q4(a),  $r(10) = .66, p = .039$ , and for Q4(b),  $r(10) = .89, p < .001$ . In Q4(a) self-direction,  $r(1313) = .08, p = .002$ , and stimulation,  $r(1313) = .08, p = .005$ , correlated positively with a preparedness to risk a certain £240 gain for a 25% chance to gain £1,000. The opposing values of conformity,  $r(1313) = -.06, p = .037$ , and security,  $r(1313) = -.07, p = .014$ , correlated negatively. In Q4(b) hedonism,  $r(1313) = .07, p = .011$ , and stimulation,  $r(1313) = .09, p = .001$ , correlated positively with a preparedness to accept the risk of a 75% chance of losing £1,000 to avoid a loss rather than accept a certain loss of £750. The opposing values of tradition and conformity correlated negatively:  $r(1313) = -.07, p = .007$ , and  $r(1313) = -.11, p < .001$  respectively.

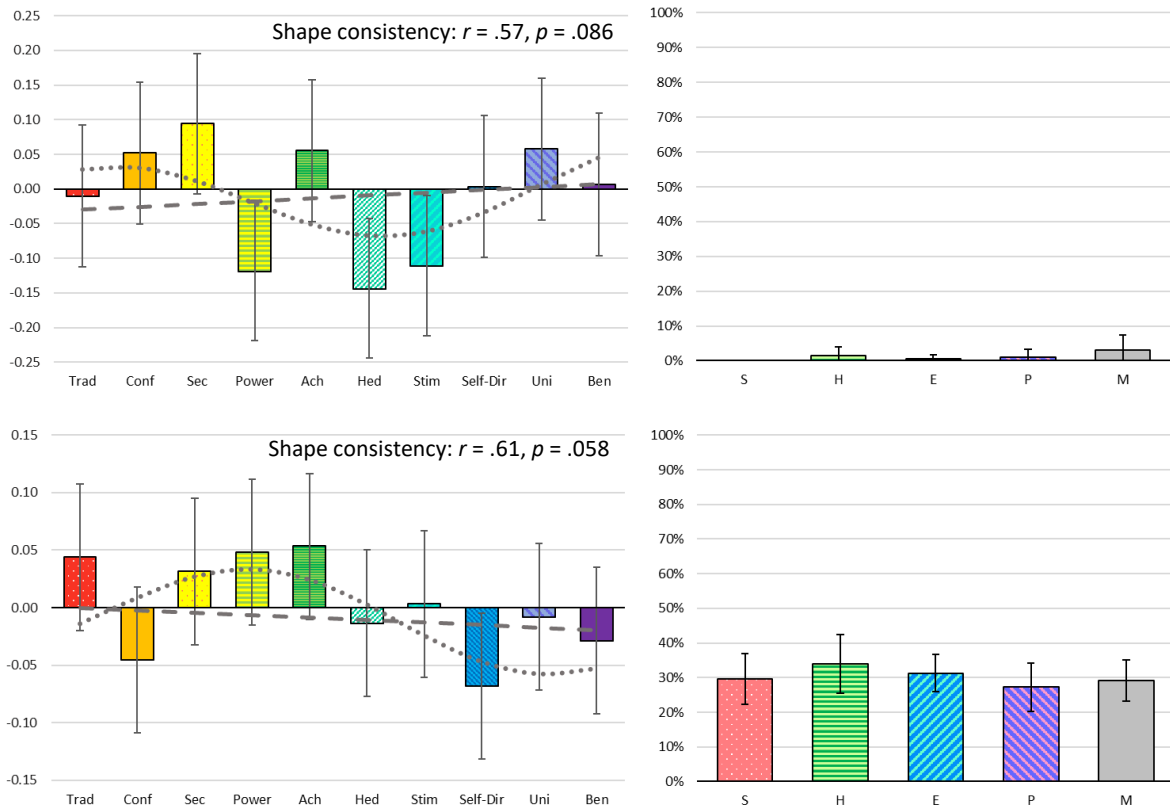
In respect of both parts Explorers exhibited the greatest preparedness for risk-taking and Shepherds the least. Differences in the relative preparedness for risk taking among the motivational types were exaggerated in Q4(b) when losses rather than gains were at stake. In Q4(a) 41% of Explorers (and Philosophers) and 32% Shepherds were prepared to take the risky option. In Q4(b) 55% of Explorers chose the risky option and 41% of Shepherds: relative differences with respect to the average preferences of Shepherds of 27%,  $\chi^2 = 3.91$ , CI = 0.17-0.00,  $p = .048$  and 33%,  $\chi^2 = 9.54$ , CI = 0.22-0.05,  $p = .002$ . respectively.



**Fig. 8.** Values correlations and motivational type for correct answers to Q5: 'If it takes 10 combine harvesters, etc.',  $N=1131$ .

The medium value consistency between the theoretical tilted sinusoidal wave and the value/correct response correlations (see fig. 8) fell short of statistical significance  $r(10) = .61, p = .063$ . While the positive correlations of self-direction,  $r(1131) = .21, p < .001$ , and universalism,  $r(1131) = .11, p < .001$ , and the negative correlations of tradition,  $r(1131) = -.19, p < .001$ , and conformity,  $r(1131) = -.09, p = .002$ , would otherwise have broadly aligned with a theoretically ideal tilted sine wave, the positive correlation of power,  $r(1131) = .15, p < .001$  in particular disrupted such a pattern. These correlations translated to 63% of  $N=202$  Philosophers (the most successful type) answering correctly, compared to 45% of  $N=163$  Shepherds (the least successful type), i.e., being relatively 38% more successful,  $\chi^2 = 11.13$ , CI = 0.28-0.07,  $p < .001$ .

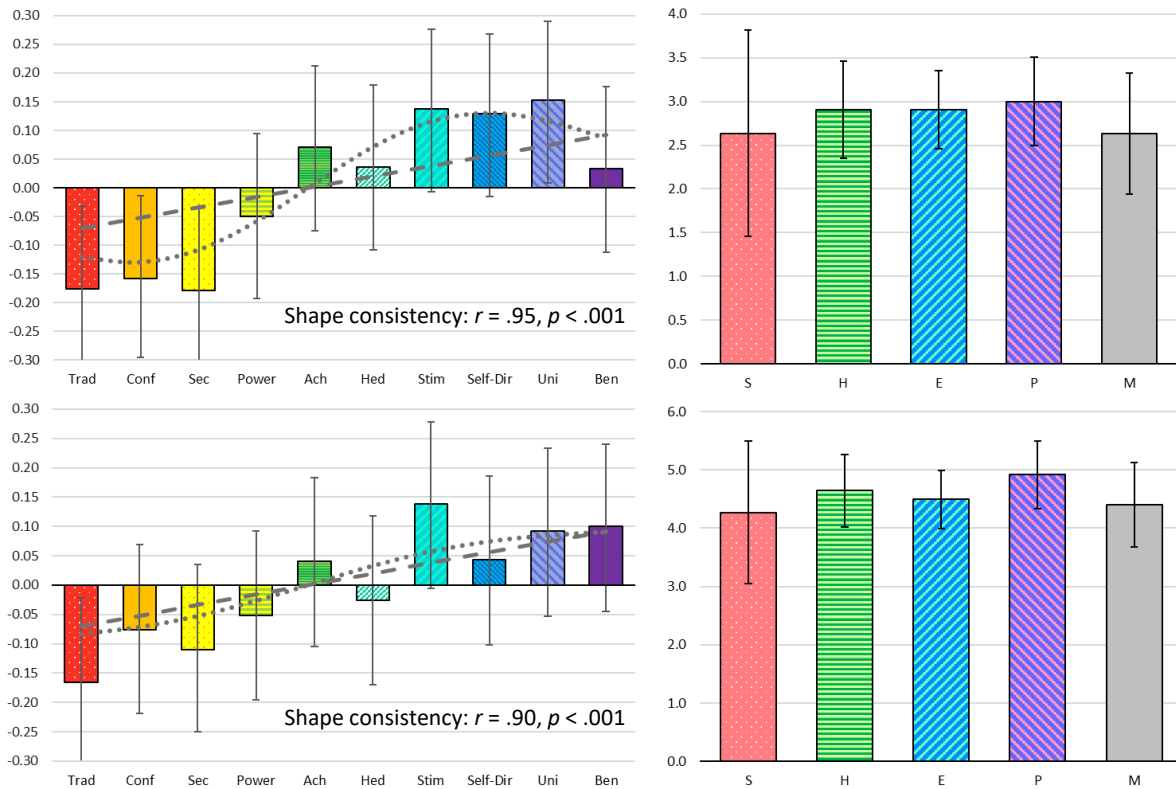
## Choices, Frames & Personal Values



**Fig. 9.** Values correlations and motivational type for correct answers to Q6: Bayesian inference challenges: (i) chance of being infected,  $N=365$  (above), and (ii) chance of correct identification,  $N=946$  (below).

As reflected in fig. 9, while it was possible to find medium value consistency between tilted sinusoidal waves and value/correct answer correlations, not so as to achieve statistical significance: Q6(i),  $r(10) = .57, p = .086$ , and Q6(ii)  $r(10) = .61, p = .058$ . While less than 5% of respondents answered Q6(i) correctly, power,  $r(365) = -.12, p = .022$ , hedonism,  $r(365) = -.14, p = .005$  and stimulation,  $r(365) = -.11, p = .032$ , all correlated negatively with answering correctly. Moderators performed better than all other types, with 14% of  $N=63$  answering correctly, compared to 0% of  $N=31$  Shepherds,  $\chi^2 = 4.90$ ,  $CI = 0.23-0.06, p = .027$ , and 2% of  $N=121$  Explorers,  $\chi^2 = 6.84$ ,  $CI = 0.22-0.04, p = .009$ . When an alternative form of Bayesian inference challenge offering a multiple (three) choice response was presented in Q6(ii) the proportion of participants answering correctly rose to

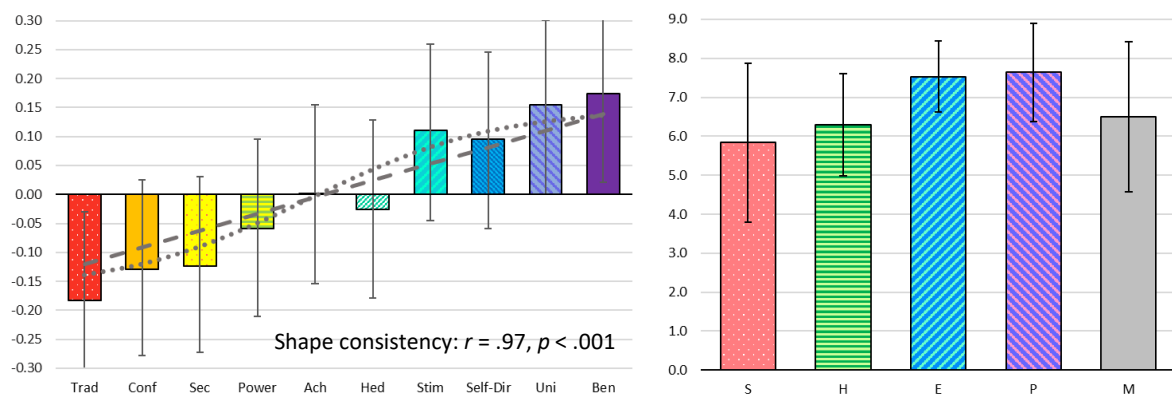
31%. Moderators then performed close to the average of all types, with no type performing significantly better than another.



**Fig. 10.** Values correlations and motivational type for performance in Q7: the fluid intelligence test, over the first four puzzles (above) and in total (below)  $N=185$ . 95% confidence intervals shown.

Fig. 10 describes performance in respect of Q7. Performance after the first four puzzles was little different than what might have been anticipated had participants guessed randomly, and so the results for the first four puzzles have been shown independently. In both cases, patterns of value/correct answer correlations showed large value consistency with tilted sinusoidal waves, but with the sinusoidal component much reduced over all ten puzzles: first four,  $r(10) = .95, p < .001$ , and all ten,  $r(10) = .90, p < .001$ . In respect of the first four puzzles tradition,  $r(185) = -.18, p = .015$ , conformity,  $r(185) = -.16, p = .030$ , and security,  $r(185) = -.18, p = .013$ , all correlated negatively, and universalism positively,  $r(185) = .15, p = .036$ , with above average performance. A sympathetic

pattern of performance was observed in the motivational types, albeit the differences fell below significance. Only tradition correlated significantly with performance in respect of all ten puzzles,  $r(185) = -.17, p = .023$ . In respect of a possible relationship between intelligence and performance in the other challenges, only creativity as measured by responses to Q8,  $r(162) = .19, p = .014$ , correlated significantly with performance in the fluid intelligence test<sup>6</sup>.



**Fig. 11** Values correlations and motivational type for performance in Q8: How many uses can you think of for an empty plastic lemonade bottle (in two minutes)?  $N=163$ .

As shown in fig. 11, the creativity of participants in their performance in Q8 yielded a largely hierarchical pattern of correlations. This showed large value consistency with the theoretical waveform,  $r(10) = .97, p < .001$ . Tradition exhibited a negative correlation of  $r(163) = -.18, p = .017$ , with performance, while universalism,  $r(163) = .15, p = .046$ , and benevolence,  $r(163) = .17, p = .024$  (values at the opposite end of the proposed linear motivational spectrum) exhibited positive correlations. However, when corrected for intelligence, as measured by performance in the first four puzzles of Q7, self-direction exhibited a positive correlation of  $r(162) = .329, p < .001$ <sup>7</sup>. The theoretical shape consistent pattern of correlations was reflected in the performance of the

<sup>6</sup> And only in respect of the first four puzzles

<sup>7</sup> With attenuation adjustment

motivational types, with Philosophers scoring 32% more on average than Shepherds,  $t(16) = 1.78^8$ ,  $p = .047$ ,  $d = 0.604$ .

#### **4. Discussion**

Theoretical expectations arising from both circular and linear interpretations of the Schwartz (1992) system of values were largely met by our findings. Taken together these suggest values play important roles in systems 1 and 2 thinking and in mediating between the two. The linear components of correlations, particularly those relating to intelligence and creativity, are consistent with the hypothesis that the system of values identified by Schwartz (1992) evolved sequentially in sympathy with an equivalent of Maslow's (1943) hierarchy.

##### **4.1 Linear and circular patterns of influence**

In respect of all challenges, to maximise consistency between patterns of value/response correlations and the theoretical sinusoidal wave form anticipated, it was necessary to introduce linear components consistent with the proposed hierarchical evolutionary structure. The relative contributions of the linear components were small in respect of Q1(i), Q2, Q4(b), and Q6(i), less so in respect of Q3 and Q6(b), and of similar importance to the sinusoidal components in respect of Q1(ii), Q4(a), Q5, and the first four puzzles in Q7. For Q7 as a whole and in respect of Q8, not only was the hierarchical linear pattern the most important, but it contributed to two of the largest consistencies between theoretical ideals and research findings.

While there were no significant differences in the performance of different motivational types in relation to the RPM (Raven, et al., 1998), the large value consistencies shown in respect of Q7

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<sup>8</sup> One-tailed

suggest these would likely emerge from the testing of a larger sample. Despite an even smaller sample completing Q8, and there being no significant single value correlations, the largely linear  $r = .97$  shape consistency contributed to a significant difference between those belonging to the motivational types at opposite ends of the hierarchical spectrum.

The complementary relationship between the performance of the different motivational types and the large consistencies between theoretically ideal waveforms and value/response correlation patterns comprising often insignificant individual value correlations demonstrates the importance of systematic analysis when considering the influence of values. For example, self-actualizing Philosophers were over 30% more likely than conservative Shepherds to opt for deferred gratification in Q1(ii), yet the only statistically significant single value correlation was for stimulation, which accounted for just 0.6% of the variation in decision-making.

### **4.2 The relative performance of conservative Shepherds**

The expectation that Shepherds would be the most risk averse in respect of Q1-Q4 and the lowest scoring type in the problem solving and creative challenges was met with three partial exceptions. In Q1(i) the 'risky' option was deemed to be sufficiently low risk to be similarly attractive to all types. When the deferred option was made a little less attractive in Q1(ii) Shepherds were found to be the most risk averse. The presentation of Q3 was such that the assessment of safety and risk became more ambiguous. Is it safer to have a 45% chance of saving everyone (i.e., a 55% chance of saving no one), or be certain of saving 30% while leaving 70% to die? Shepherds, Hunters and Explorers were similarly divided between the two options. While Shepherds performed the worst in respect of Q6(i), they were average performers in respect of Q6(ii), but low overall success rates and lack of differentiation respectively limit what can be drawn from these results.



#### **4.2 The relative performance of self-enhancing Hunters**

The expectation that Hunters would be the next most risk averse and next least creative was also largely borne out. Hunters scored the second lowest of the four hierarchical types in Q1(ii), Q4 and Q8. For Q2 they were the second most likely to accept the best, being a little more likely than Philosophers (albeit the difference fell short of significance). As previously described, Q1(i) and Q3 were not capable of eliciting clear differences in the risk aversion of individuals belonging to the different motivational types.

While inconclusive, the results in respect of Q1 and Q4(a) suggest Hunters may be the least risk-averse when potential losses, relative to potential gains, are perceived to be small. While the differences in responses to Q1 between Hunters and the other types fell below statistical significance, the profile of the underlying value correlations (power excepted) suggests that a larger sample may have showed Hunters to be the least risk averse of the four hierarchical types in relation to Q1(i). 88% of Hunters were prepared to accept the perceived risks associated with deferring reward, compared to 80-86% of the other types in Q1(i), yet, when deferment was increased and the amount to the deferred reward was reduced, they became the second most risk averse.

#### **4.3 The relative performance of open Explorers**

Again, excepting Q1(i) and Q3, and in line with expectations, Explorers were the least risk averse of the types: significantly less risk averse in their willingness to potentially lose £100 for an even chance of winning £200, and as willing as Philosophers to take the risky options in Q1(ii) and both parts of Q4. The pattern of value/response correlations in respect of Q1(ii) (see fig.4) shows the relationship between stimulation and hedonism (pro-risk) and tradition, conformity, and security (risk averse) to be the most influential. These values are likely to be of the greatest and least importance to Explorers respectively. Despite there being no significant difference between

Explorers and Philosophers in the responses to Q4(b), that 55% of Explorers chose to risk losing £1000 rather than £750 for a 25% chance of losing nothing, compared to 53% of Philosophers, was underpinned by a similar pattern of correlations to that for Q1(i), but with significant value correlations for stimulation, hedonism, conformity, and tradition (as shown on fig.7).

#### **4.4 The relative performance of self-actualizing/transcending Philosophers**

The only question that tested attitudes to potential losses independently of those for potential gains was Q4(b). The expectation that Philosophers would be the least sensitive to potential losses was borne out inasmuch as there was no significant difference between Philosophers and Explorers as the least loss averse types. While a hierarchical influence of values was apparent (see fig.7), the sinusoidal influence appeared stronger. Comparing responses to Q2 and Q4(b), had it not been for Philosophers' relatively greater preparedness to accept losses in the absence of real potential gains, one might have expected them to have responded similarly to Hunters, in accordance with a circular pattern of correlations.

The only question that addressed the interests of others, and therefore tests the expectation that Philosophers give priority to the interests of others, was Q3. If one considers the proposition as if it were a repeatable proposition, it should be logically decided upon with reference to its equivalent value. Considered as such, Q2 effectively offered a choice of a gift of £50 ( $-\text{£}100/2 + \text{£}200/2 = \text{£}50$ ) or £0, and the two options in Q3 of saving 45% or 30% of the population. However, given that a loss of £100 is more bearable than the loss of a life, let alone 1 million lives, Q3 would seem less likely to be considered an acceptable repeatable proposition. If the decision-maker should choose Medicine B, it is more likely than not that all the lives entrusted to them will be lost. Consequently, an argument can be made that guaranteeing the lives of 30% with Medicine A is the more logical decision. If one considers those for whom the decision-maker is responsible to be their 'tribe', Medicine A

guarantees the survival of the tribe, whereas Medicine B makes it 55% likely it will be extinguished. Considered in this light, even if the proposition was treated as repeatable, that 62% of Philosophers preferred Medicine A makes sense from an evolutionary perspective, since Medicine B effectively guarantees extinction of the tribe in the long-term. On this basis, the shape consistency of the correlation waveform that shows self-direction and benevolence tending to support Medicine A could be deemed to satisfy theoretical expectations.

The expectation that Philosophers would be the most likely to display rationally enhanced intuition seems to have been met with responses to Q5, but not with respect to Q6. Supported by the positive contributions of self-direction and universalism, Philosophers were 26% more successful than the average of the other four types in answering Q5 correctly.

Expectations that Philosophers would score the highest in respect of Q7 (the fluid intelligence test) and Q8 (the creativity test) were met. While the differences between the types fell below significance, that they were supported by value/response correlation patterns with strong linear influences displaying large shape consistencies with theoretical ideals, suggests that a larger sample would have yielded significant differences between the types. For both Q7 and Q8, the 'higher' values of stimulation, self-direction, universalism, and benevolence were seen to promote above average performance, while the 'lower' values of tradition, conformity, security, and power inhibited it.

### **4.5 The relative performance of conflicted Moderators**

The expectation that Moderators would respond more rationally to propositions likely to elicit intuitive erroneous responses would be revealed in a greater proportion of Moderators giving

correct answers than other types. This only happened in respect of Q6(i). Of the two questions likely to elicit an intuitive response that could be answered correctly (Q5 being the other) only Q6(i) invited open answers. The most frequent intuitively satisfactory answer was 99%. The correct answer of 50% required calculation, unless respondents had previously encountered the same or a similar question or made a lucky guess. Moderators performed better than all the other types put together, but an average all participant success rate below 5% undermines the confidence one can place in this finding. The amendment made to Q6, particularly the multiple-choice element, was intended to help in this regard, but failed to do so. All types were similarly more successful when responding to Q6(ii), but only insofar as the average success rate was raised to a little below what might have been expected had respondents guessed randomly. For the only other question likely to elicit a wrong answer (Q5), Moderators performed no better than the other types.

Moderators are likely to be least affected by the positive and negative biases associated with the values most likely to influence a decision, because no triad of complimentary values plays a dominant role in their motivational systems. As such, had the expectation for Moderators to exhibit a more rational approach to decision-making been baseless, one might have also expected them to perform close to the average of the other types. They did so in respect of Q4(b), Q5 and Q6(ii), however, in Q1, Q2, Q3, Q4(a), Q7 and Q8 they performed similarly to other types at the extremes. Except in respect of Q2, the differences between Moderators and other similarly performing types were not statistically significant but, considered in the context of the good correspondence between value/response correlation patterns and theoretical ideals, these anomalies invite further investigation. That Moderators were only a little less likely than Philosophers to choose Medicine A in Q3 may be seen to meet expectations related to enhanced rationality, as might their similar preference for deferment in Q1(ii) given the 65% pa return on offer. Set against this, Moderators were among the least likely to accept what may be considered the equivalent of a gift of £50 in response to Q2.

#### 4.6 Anomalies

Given the large degree of consistency between theoretically ideal combinations of linear and sinusoidal patterns and measured value correlations in six of the twelve set out in figs. 4-11, one is drawn to consider why similar levels of consistency were not present in the other six. Some variation in decision-making arising independently from differences in values is to be expected. If identical twins with identical value systems were asked which of two liquids they would prefer to drink, if one of each pair had already tasted both, and found the most visually appealing tasted disgusting, the likely resulting bias in decision-making could be explained by prior experience alone. However, when large samples of individuals with different value systems are presented with simple challenges, it is likely that factors affecting decision-making independently of values will be evenly distributed, and so are less likely to give rise to misleading value/response correlations.

Complex propositions may be considered an amalgam of multiple individual propositions, each capable of eliciting distinct values-related responses. Accordingly, one might expect responses to such propositions to betray more than one pattern of value/response correlations. Indeed, the apparent coincidence of linear and sinusoidal patterns in our findings supports this notion for even these relatively simple propositions. Therefore, it may be that in those examples where shape consistency was between  $r = .52$  and  $r = .70$ , more than two values-related influences were involved, and the resulting patterns of value/response correlations arose from the superposition of different sinusoidal and linear patterns.

The capacities for independent thought and action associated with self-direction are inextricably linked with intelligence and creativity. That the response/value correlations between self-direction and success in Q7 and Q8 fell below levels suggested by the theoretically ideal waveforms shown in

figs. 10 & 11, and below those for the neighbouring values of stimulation and universalism, is puzzling. It may be this is a consequence of discrepancies between self-evaluation and reality. The average Hunter profile shown in fig. SM2 shows self-direction scoring higher than might have been expected given the trend of scoring in neighbouring values. It suggests Hunters over-estimate the importance and influence of self-direction; perhaps confusing self-direction with the self-importance one might associate with power. The average Shepherd profile (see fig. SM2) suggests Shepherds may be prone to similar self-awareness issues, given that the independent thought and action associated with self-direction are directly frustrated by the influence of the conservative values: particularly conformity, which was shown to be their most important value.

### **4.7 Strengths, limitations, and directions for future research**

Our findings illustrate the systematic relationships between values and decision-making in relation to challenges designed to test system 1 related intuitive biases, and propensities for engaging system 2, rational thought (Kahneman, 2011; Stanovich & West, 2000). They also demonstrate how values influence our rational and creative capabilities in accordance with an evolutionary and hierarchical interpretation of Schwartz's (1992) system. As such they advance our understanding of the role played by values, how they might have evolved, and how they affect the decision-making of differently motivated individuals.

The decision-making challenges adapted from Kahneman (2011) and Paulos (1988) were originally designed to explore general tendencies for irrational and potentially sub-optimal thinking. In adopting them our intention was explore whether and how these tendencies varied among differently motivated individuals according to their values. The findings suggest systematic, personal values-related differences in Prospect Theory's (Kahneman & Tversky, 1979) value function as it relates to differently motivated individuals in different situations. While we did not set out to

demonstrate or explore the practical consequences of such interpersonal differences, the findings suggest a better understanding of the impact of values-related decision-making biases on individuals, organizations, and society could be of great benefit. The general tendency to refuse risking the loss of some amount for the potential to gain twice that amount on the toss of a coin is described by Kahneman (2011) as being analogous to the type of proposition that may be encountered by many and on many occasions. Since repeated refusals become equivalent to turning down opportunities offering near certain gains, this tendency alone may have striking consequences for individuals, organizations, and society. That open Explorers were 224% more likely to take this bet than conservative Shepherds, 180% more likely than Philosophers and Moderators, and 143% more likely than Hunters, illustrates how differences in the motivational systems of organizational decision-makers, consumers, and voters might impact on the well-being of individuals, organizations, and societies through values-related decision-making.

While there is a strong rational argument in favour of accepting the bet in Q2 based on equivalent values, even in situations where there was little (e.g., Q4i) or no difference (e.g., Q4ii) in the equivalent values of the binary options, personal values evidently still played a systematic role in discriminating between the two. In these examples, in accordance with Prospect Theory (Kahneman & Tversky, 1979), the differences were shown to be more sensitive to potential losses than gains. These findings demonstrate that even small values-related biases may significantly impact on outcomes when systematic interactions are considered. For example, the substantial differences in the responses of the different motivational types to Q2 arose from the systematic interactions of values; none of which accounted for more than 7% of the variation in decisions made. In respect of Q3, the largest single value/response correlation (for benevolence) was responsible for little more than 0.5% of the variation in responses but contributed to Hunters being 28% more likely than Philosophers to prefer a 55% chance of allowing 1 million to die than the certainty of saving 30% of them. It is perhaps worth mentioning that in highly competitive environments, such as those

encountered in sport, business and politics, even small, marginal differences can have considerable effects. For example, the national referendum by which the United Kingdom voted to leave the European Union, and thereby change the social and political course of a nation, was decided on a 51.9%:48.1% split in the vote (BBC, 2020).

Just as systematic biases within the value systems of individuals appear to magnify the influence of individual values, one can anticipate that systematic biases in populations, whether in organizations or nations, have the potential to magnify the influence of individual differences. Indeed, given that organizations tend to foster cultures, and therefore individuals, sympathetic to the value priorities of their leaders (e.g., Hoffmann, et al., 2011), and alignment between personal and organizational interests is thought to promote competitive advantage (e.g., Gottschalg & Zollo, 2007), the effects of consistent decision-making biases seem likely to be exaggerated and compounded in organizations.

Organizational decision-makers are subject to prescriptive guidelines and cultural pressures (e.g., Jabs, 2005; Weber et al., 2005), which may be as influential as their values and other personal biases. For them and other individuals, any real-life decision-making challenges deemed comparable to those we posed are likely to be made in the light of other considerations salient to values, such as previous experiences, their impact on others, and how they will be viewed by others. Consequently, to appreciate the effect of values-related motivational biases on individual and corporate decision-making more fully, would necessitate investigating the potentially complex interactions between such factors.

Values represent specific yet abstract motivational concepts related to each other such that they may be approximately located in a continuous motivational space (Schwartz, 1992). The sinusoidal patterns of value/response correlations we found further endorse the established utility of



Schwartz's (1992) values theory and PVQ-40 (Schwartz, et al. 2001). However, the extent to which this system may be explored with a self-reporting measure may be restricted. Griffiths et al. (2021) contend this system represents a universal evolutionary motivational construct that relates to all complex adaptive systems, including the patterns of electro-chemical activity in the human brain that give rise to our values. The use of the DNA methodology to distinguish motivational types allowed us to better understand how systematic differences in the operation of individual value systems affect thinking and behaviour, but systematic neurological studies are probably required if we are to arrive at a deeper understanding.

Budgetary constraints and a desire to make participation easier, and so expedite the gathering of data within time constraints, limited our ability to compare the relationship between intelligence, values, and decision-making. Research to analyse the performance of much larger samples with respect to a variety of measures of intelligence would shed further light on the apparent hierarchical relationship between values and intelligence, and their distinctive influences.

As was demonstrated by changing considerations of delayed gratification in Q1, and the presentation of Q6, values-related response sensitivity changes when variables are changed. Inevitably, when the disparity between the perceived attractiveness of options becomes too small or great there will tend to be agreement between decision makers regardless of their values. However, between these limits the influence of values can be expected to vary. Having established that values influence responses to non-values-laden propositions, future research may better investigate the range of this influence and possible 'sweet spots' of maximum values-related disparity between motivational types.

## **5. Conclusion**

The aims of this research were to explore whether values exert an influence on rational and irrational decision-making when propositions are not overtly values laden, and to ascertain whether any such influence betrayed both the familiar circular/sinusoidal patterns and linear/hierarchical patterns consistent with an evolutionary interpretation of Schwartz's (1992) system of values. Our findings suggest that the answer to both questions is yes: values play a role in system 1 and 2 thinking (Stanovich & West, 2000) and in mediating between them. They also provide support for Griffiths et al.'s (2021) evolutionary theory that intelligence and creativity evolved in sympathy with the 'higher' values of hedonism, stimulation, self-direction and universalism, and the type of benevolence related to universalism. Taken together these findings invite further investigation, and perhaps a reappraisal, of the role values and their equivalents play in guiding personal decision-making, and, when considered collectively and systematically, in shaping society.

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