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Decision-making competence: More than intelligence?

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ABSTRACT

Decision-making competence refers to the ability to make better decisions, as defined by decision-making principles posited by models of 'rational choice.' Historically, psychological research on decision making research has examined how well people follow these principles under carefully manipulated experimental conditions. When individual differences received attention, researchers often assumed that individuals with higher fluid intelligence would perform better. We describe the development and validation of individual-differences measures of decision-making competence. Emerging findings suggest that decision-making competence may tap into fluid intelligence, but also into motivation, emotion regulation, and experience (or crystallized intelligence). Although fluid intelligence tends to decline with age, older adults may be able to maintain decision-making competence by leveraging age-related improvements in these other skills. We discuss implications for interventions and future research.

Key words: Decision-making competence, individual differences, cognitive ability

DECISION-MAKING COMPETENCE: MORE THAN INTELLIGENCE?

People of all ages face decisions that affect their health, finances, and well-being. Making good decisions should help them to obtain better outcomes. Decision-making competence refers to the ability to follow decision-making principles that have been proposed by models of 'rational choice.' Table 1 describes six tasks that assess adherence to each of these decision-making principles, selected to cover complementary components of decision-making competence (Parker & Fischhoff, 2005).

This paper will focus on two of these tasks, because of the insights they have provided about decision-making competence and the skills it taps into across the life span. First, Applying Decision Rules entails identifying the best option among alternatives with multiple attributes, such as health treatments, pension plans, or consumer products (Bruine de Bruin et al., 2007; Parker & Fischhoff, 2005; Payne, Bettman, & Johnson, 1993). Second, Resistance of Sunk Costs entails abandoning investments with irrecoverable losses, if alternatives provide better future outcomes (Arkes & Blumer, 1985).

Table 1: Decision-Making Competence tasks

Task	Assessed decision-making principle
Applying Decision Rules	Correctly applying predefined strategies for choosing between available options
Resistance to Sunk Costs	Abandoning previously chosen options with irretrievable losses (or 'sunk costs'), if other options offer better future outcomes
Resistance to Framing	Judging the value of an option independent of whether its outcomes are described in positive or negative terms (e.g., 75% success rate vs. 25% failure rate)
Consistency in Risk Perception	Assessing the likelihood of relative outcomes in ways consistent with probability theory (e.g. the probability of two mutually exclusive options should add up to 100%)
Recognizing Social Norms	Knowing how peers evaluate the acceptability of potentially negative behaviors (e.g., stealing)
Under/Over-Confidence	Recognizing the strengths and limitations of one's knowledge

Note: For more information about these assessments of decision-making principles and how tasks were selected, please see Parker & Fischhoff (2005)

Initial Psychological Tests of Decision-Making Principles

Decision-making researchers have long suggested that adhering to the decision-making principles of 'rational choice' can be cognitively demanding (Edwards, 1954). To understand when people may violate these decision-making principles, psychological research has typically involved careful experimental manipulations of the conditions under which decisions were made. For example, studies have found that people are less able to apply decision rules, when the rules are more complex, the number of options increases, or time pressure is added (Payne et al., 1993). Studies have also found that people are more likely to become concerned about 'wasting' prior investments and violate the sunk-cost principle when irrecoverable losses are larger (Arkes & Blumer, 1985).

Because these studies focused on when decision-making principles were violated, they paid little attention to who would be more prone to such violations. Progress on understanding individual differences was further hampered by three additional features that were common to the research. First, each study typically assessed adherence to one decision-making principle at a time, without asking whether individuals who were better able to follow one principle were also better able to follow others. Second, other skills were rarely measured, leaving it unclear how similar or different decision-making competence was from, for example, fluid intelligence. Third, performance was typically measured on artificial decision tasks, which may not capture how people actually make decisions in their lives.

Individual-Differences Measures of Decision-Making Competence

Studies of individual differences in decision-making competence began with several concurrent research programs. Each suggested that there are stable individual differences in the ability to adhere to different decision-making principles. In samples of undergraduate students, Stanovich and West (1998) found that performance was positively correlated across a suite of tasks that assessed adherence to different decision-making principles. In a sample

of younger and older adults who completed a different set of decision tasks, Finucane and colleagues (2002) also found that performance was positively correlated. Meanwhile, we created a battery of tasks assessing adherence to the decision-making principles displayed in Table 1, suited to adolescents (Parker & Fischhoff, 2005) and adults (Bruine de Bruin, Parker, & Fischhoff, 2007). With both samples, we found that performance was positively correlated across the presented tasks. Table 2 shows examples of the two tasks that assessed Applying Decision Rules and Resistance to Sunk Costs.

Table 2: Example items assessing Applying Decision Rules and Resistance to Sunk Costs

Applying Decision Rules

		Features				
		Picture Quality	Sound Quality	Programming Options	Reliability of Brand	Price
DVD	A	3	1	5	2	$369
	B	1	2	1	2	$369
	C	5	4	3	1	$369
	D	4	2	3	3	$369
	E	4	4	2	4	$369

Lisa wants the DVD player with the highest average rating across features.

Which **<u>one</u>** of the presented DVD players would Lisa prefer? _____

Resistance to Sunk Costs

You are buying a gold ring on layaway for someone special. It costs $200 and you have already paid $100 on it, so you owe another $100. One day, you see in the paper that a new jewelry store is selling the same ring for only $90 as a special sale, and you can pay for it using layaway. The new store is across the street from the old one. If you decide to get the ring from the new store, you will not be able to get your money back from the old store, but you would save $10 overall.

Would you be more likely to continue paying at the old store or buy from the new store?

1	2	3	4	5	6
Most likely to continue paying at the old store				Most likely to buy from the new store	

Over the past 15-20 years, a growing body of evidence has replicated these positive correlations across decision-making competence tasks. Studies using our decision-making competence measure have replicated that finding with, for example, early and late adolescents in the US; undergraduate students from Italy, China and Slovakia; adults in the US, UK, and Sweden; US adults with autism spectrum disorder; and Swedish adults with ADHD (Bavolar, 2013; Bruine de Bruin et al., 2007; Del Missier, Mäntyla, & Bruine de Bruin, 2012; Del Missier et al., 2013, 2017; Eberhardt, Bruine de Bruin, & Strough, 2018; Levin et al., 2015; Liang & Zou, 2018; Mäntyla, Still, Gullberg, & Del Missier, 2012; Parker & Fischhoff, 2005; Weller, Levin, Rose, & Bossard, 2012). In an 11-year longitudinal study, we found positive correlations between decision-making competence tasks, as well as between assessments at age 19 and age 30, suggesting robustness in decision-making competence over time (Parker, Bruine de Bruin, Fischhoff, & Weller, 2018).

There is also evidence for the predictive validity of our decision-making competence measure, as seen in correlations with real-world outcomes. Adolescents with higher overall decision-making competence scores were less likely to report behaviors that suggest poor decisions, such as juvenile delinquency and drug use (Parker & Fischhoff, 2005). Adults with higher overall decision-making competence scores reported fewer negative life events on the Decision Outcome Inventory, such as type 2 diabetes and bankruptcy (Bruine de Bruin et al., 2007). Moreover, decision-making competence at age 10-11 has predicted interpersonal problems two years later (Weller, Moholy, Bossard, & Levin, 2015). Thus, despite using hypothetical decision tasks, decision-making competence assessments appear to measure abilities that are relevant to real-world outcomes.

More Than Just Intelligence?

Decision-making competence was originally hypothesized to be a cognitive skill related to fluid intelligence (e.g., Bruine de Bruin, Parker, & Fischhoff, 2012). Various studies have indeed found moderate positive correlations between overall performance on our decision-making competence tasks and fluid intelligence (as measured on for example Raven's Standard Progressive Matrices), executive cognitive functioning (e.g., inhibition, monitoring, and shifting), and numerical skills (Bruine de Bruin et al., 2007; Del Missier, et al., 2012, 2013, 2017; Parker & Fischhoff, 2005; Weller, Levin, Rose, & Bossard, 2012; see also Toplak, Stanovich & West, 2011).

However, there is also increasing evidence suggesting that decision-making competence may be conceptually distinct from fluid intelligence. First, correlations between overall decision-making competence scores and life events reported on the Decision Outcome Inventory remain after controlling for fluid intelligence (Raven's Standard Progressive Matrices), as well as crystallized intelligence (Nelson-Denny), socio-economic status and demographics (Bruine de Bruin et al., 2007). This finding suggests that decision-making competence may capture skills other than fluid intelligence, with relevance to life outcomes. Second, correlations between performance and fluid intelligence differ across the decision-making competence tasks, suggesting that they tap different skills. For example, performance correlates more strongly with measures of fluid intelligence for 'Applying Decision Rules' than for 'Resistance to Sunk Costs' (Bruine de Bruin et al., 2012; Del Missier et al., 2012, 2013; Parker & Fischhoff, 2005). Third, decision-making competence may tap into more than just fluid intelligence, as seen in its additional positive correlations with motivation, emotion regulation, and experience (Carnevale, Inbar, & Lerner, 2012; Eberhardt et al., 2018). Individuals who are motivated to think harder about complex tasks (also referred to as 'need for cognition') may perform better on tests of numeracy and

decision-making competence (Bruine de Bruin, McNair, Taylor, Summers, & Strough, 2015; Carnevale, Inbar, & Lerner, 2012). Emotional skills may support decision-making competence by enhancing the interpretation of past experiences and new information, directing attention, and facilitating comparisons between options (Peters, 2006). Individuals who have more experience with specific decisions may not need to deliberate as much about those decisions, because they have acquired crystallized intelligence and already learned what to do (Li, Baldassi, Johnson, & Weber, 2013). Thus, decision-making competence may reflect a combination of intellectual, motivational, emotional, and experience-based skills.

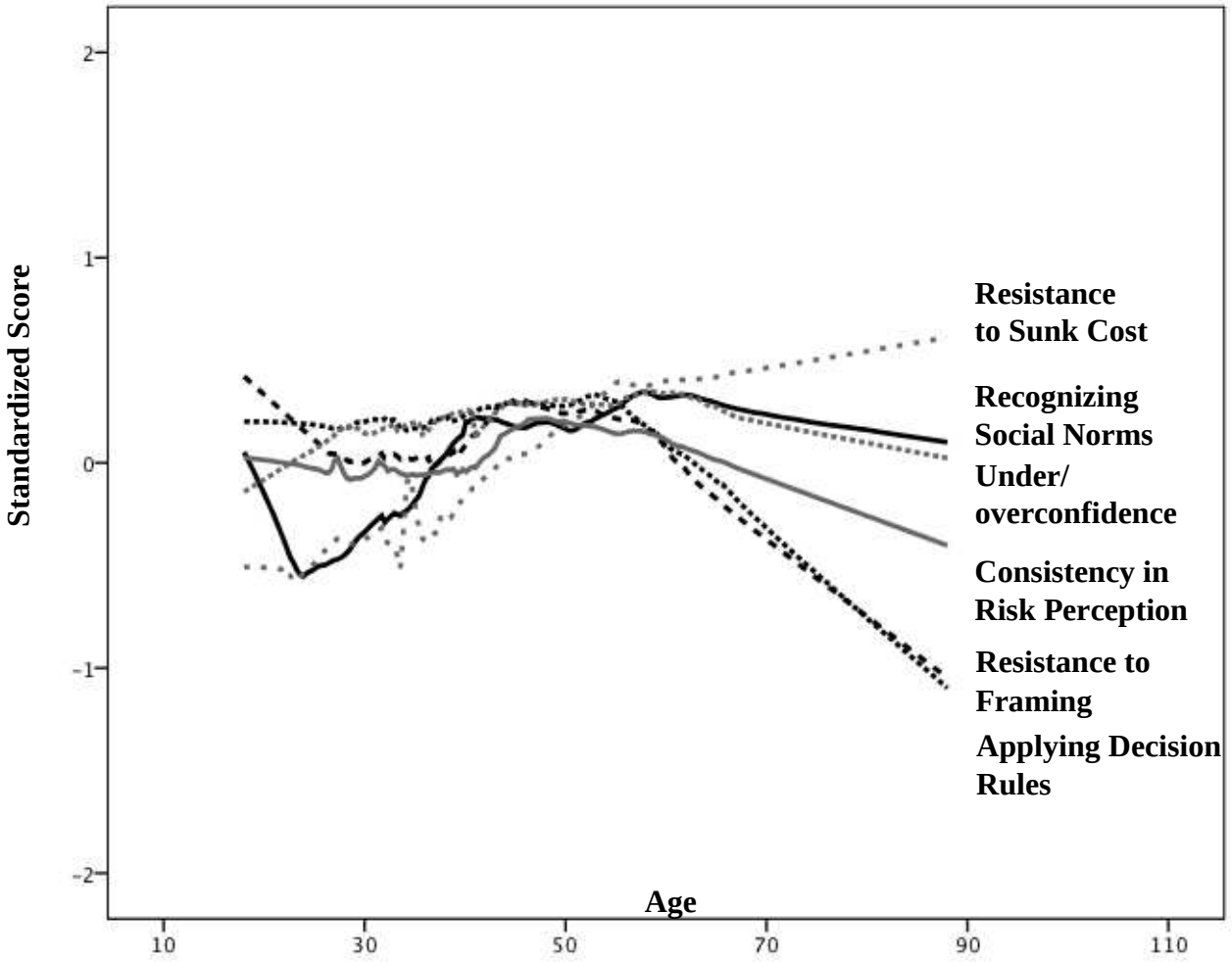
Age Differences in Decision-Making Competence

Given well-documented age-related declines in fluid intelligence, initial research on age differences in decision-making competence hypothesized that older adults would perform worse than younger adults. However, findings suggested that this was not always the case (Bruine de Bruin et al., 2012). Figure 1 shows the varying patterns of age differences in performance, for tasks assessing adherence to the decision-making principles presented in Table 1. For example, older adults performed worse than younger adults on Applying Decision Rules, but better on Resistance to Sunk Costs. Possibly, Applying Decision Rules is more cognitively demanding, and hence requires greater fluid intelligence, which declines with age. Resistance to Sunk Costs may benefit from accumulated life experience, with older adults finding it easier to walk away from poor decisions with 'sunk costs' due to having learned to worry less about losses (Bruine de Bruin, Strough & Parker, 2014; Strough, Schlosnagle, & DiDonato, 2011).

In addition to fluid intelligence, it has been suggested that motivation, emotions, and experience may also contribute to age differences in decision-making competence. For example, older adults appear more motivated to work on tasks that they find cognitively less

demanding and more personally relevant (Bruine de Bruin et al., 2015; Carstensen, 2006; Hess, Queen, & Ennis, 2013), to be less affected emotionally by negative experiences (Bruine de Bruin et al., 2014; Carstensen, 2006), and to have more life experience to guide their decisions (Li et al., 2013). Thus, age-related decline in fluid intelligence may be counteracted, and possibly overcome, by age-related improvements in experience and emotion regulation (Eberhardt et al., 2018; Li et al., 2013).

Figure 1: Age trends in performance on tasks assessing adherence to decision-making principles.



Note: Data from Bruine de Bruin et al. (2007). Figure adapted from Strough, Bruine de Bruin, & Parker (2015). Higher standardized scores reflect greater decision-making competence.

Implication for Interventions

Better understanding of how fluid intelligence and other skills support decision-making competence should facilitate the design of interventions. Below, we briefly consider directions for future research into potential cognitive, motivational, emotional, and experiential interventions for promoting decision-making competence.

In one intervention that aimed to provide cognitive support, Zwilling and colleagues (2019) found that training in core cognitive abilities improved decision-making competence, compared to an active control group (in which participants practiced to process visual information faster.) Effects of cognitive training can be enhanced by high-intensity cardio-resistance fitness training, which improves connectivity in the brain (Zwilling et al., 2019). Rosi, Vecchi, & Cavallini (2019) found that prompting older people to ask 'metacognitive' questions (e.g., what is the main information?) was more effective than general memory training for improving performance on Applying Decision Rules. This finding is in line with suggestions that older adults perform better when they are asked to explain their choices (Kim, Goldstein, Hasher, & Zachs, 2005). Additional intervention approaches have aimed to reduce the need to rely on fluid intelligence. Using simple instead of complex decision rules may decrease cognitive demands, and cause fewer errors (Payne et al., 1993). Reducing the number of options also reduces cognitive demands, and may help especially older adults to improve their choices (Tanius, Wood, Hanoch, & Rice, 2009).

Other interventions have aimed to increase motivation for making decisions. Simplifying decisions, along the lines suggested above, may motivate people to engage more

with their decisions. Framing decisions as more personally relevant may especially motivate older people (Hess et al., 2013). Motivational barriers to making decisions may potentially also be overcome by providing decision support, and by designing choice environments that draw attention to recommended options.

In addition to targeting cognition and motivation, interventions may attempt to enhance the emotion regulation that people need to apply their decision-making competence. For example, correlational evidence suggests that encouraging people to focus on the positive may reduce their concerns about losses, and improve their Resistance to Sunk Costs (Bruine de Bruin et al., 2014). Additionally, framing information in positive terms may increase older adults' motivation to use it in their decisions (Carstensen, 2006).

Finally, interventions may aim to provide people with the experience they need to master decision-making principles. For example, Larrick, Nisbett, and Morgan (1993) found that training was associated with recognizing the relevance of the 'sunk cost' principle and applying it. A high-school history curriculum that emphasized decision-making principles in decisions made by historical figures improved students' decision-making competence and their subject matter learning (Jacobson et al., 2012). These findings suggest that practicing the application of decision-making principles in protected settings may improve transfer to real-world settings.

Next Steps

Models of 'rational choice' have proposed decision-making principles. Psychological research on decision making has developed carefully crafted decision tasks that assess adherence to those principles. Based on these approaches, individual-differences research in decision-making has developed and validated measures of decision-making competence. Those measures have led to a growing body of research on the nature of decision-making

competence and its relationship to fluid intelligence, motivation, emotion, and experience. We have seven suggestions for next steps.

First, a wider range of decision-making principles and related skills could be added to the suites of existing measures, so as to better assess decision-making competence and understand the skills it taps into (as in the "Comprehensive Assessment of Rational Thinking"; Stanovich, West, & Toplak, 2016). Second, measures of decision-making competence may be used to validate measures of self-reported decision-making styles, which aim to assess, for example, how much individuals perceive themselves to be avoidant or spontaneous decision makers (Appelt, Milch, Handgraaf, & Weber, 2011; Dewberry, Juanchich, & Narendran, 2013; Parker, Bruine de Bruin, & Fischhoff, 2007). Third, more diverse and nationally representative samples are needed to improve understanding of the interplay between decision-making competence (and its components) with other skills and experiences. Fourth, creating national norms for decision-making competence may inform policies about legal protections. Fifth, a fuller picture is needed regarding decision-making competence across the entire life span, from childhood through older adulthood (Weller, Levin, & Denburg, 2011). Sixth, longitudinal studies are needed to disentangle developmental changes from cohort effects (Parker et al., 2018). Seventh, intervention studies targeting specific skills could help to identify causal mechanisms in improving overall decision-making competence and its components (following Jacobson et al., 2012).

The development of validated measures of decision-making competence provides the theoretically grounded methods for understanding how such competence develops across the life-span, how it relates to life events, and how it varies with individuals' cognitive and emotional skills, experience, and other characteristics. That knowledge should help people of all ages to make better decisions, leading to better life outcomes and well-being.

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RECOMMENDED READINGS

These papers discuss research on individual differences in decision-making competence in greater detail:

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