

Assessing How We Decide Psychometric Development of the Decision Modes Scale*

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We present the development of the Decision Mode Scale (DMS), a 24-item scale that measures the use of six decision modes, the qualitatively different processes by which individuals report making decisions: calculation, affect, habit, social norms, identity, and morality. The calculation mode involves a deliberate process of assessing costs and benefits. The affective mode involves an emotion or gut-feeling driven process. The social norms mode involves consideration of what others are doing or what others condone as appropriate. The habitual mode involves following a previously determined rule or habit. The identity mode involves identifying what action is consistent with one's sense of self or own values. The moral mode involves consideration of action provides the greatest good. The final four modes (habit, social norms, identity, and morality) are all rule-based ways of making a decision that follow a previously-learned and/or socially-derived rule or convention. The DMS exhibits good reliability and convergent and discriminant validity. By providing the DMS, we integrate past research on decision modes and create an opportunity for additional research into the effects of different decision processes on their outcomes.

Personal Note by Elke Weber

This chapter is a tribute to Christoph Engel and his important work of exploring the impact of research in psychology and other social sciences, including the decisions sciences, on legal theory and legal decision making. His impacts are seen in publications that summarize important multi- and trans-disciplinary workshops organized by him (e.g., Gigerenzer & Engel, 2006; Engel & Singer, 2008) as well as in specific research contri-

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butions (e.g., Goldstein et al., 2006; Lubell et al., 2008). My decision to contribute this chapter on the development of a Decision Modes Scale to this volume connects current work in my lab to the enjoyable time of working with Christoph on the impact of institutions on the decision of how to decide, i.e., on the decision mode(s) used by individuals (Engel & Weber, 2007), during a sabbatical leave that he spent at Columbia University.

A. Introduction

People make decisions in qualitatively different ways, which have been categorized into three decision modes: calculation-based, affect-based, and role/rule-based decision processes (Weber et al., 2005; Weber & Lindemann, 2007). Calculation-based decision making involves weighing costs and benefits. Affective decision making involves following a gut feeling. Role/rule-based decision-making takes advantage of learned habits, if-then rules, and rules of conduct imposed by professional, ethical, and social roles to guide behavior. Decision mode usage is not mutually exclusive: decision makers rely on multiple decision modes to varying extents when making any decision (Engel & Weber, 2007; Krosch et al., 2012; Reeck et al., 2022). In this paper, we refine the classification of decision modes and develop a domain-general scale to measure the extent of their use.

B. Defining Decision Modes

Much past research has documented the existence of two decision modes, sometimes labelled rational and intuitive (Evans, 2008; Evans & Stanovich, 2013; Kahneman & Frederick, 2002). The intuitive mode is automatic and involves habitual and emotional responses, while the rational mode is conscious, deliberative, effortful, and can override these intuitive processes. This two-way categorization has been subjected to multiple critiques (see Evans & Stanovich, 2013). As a way of understanding decision processes, the two categories may be too broad to usefully differentiate between different decision strategies or omit some decision modes.

Some research has described a third class of decision modes as rule-based decision modes that activate a specific rule in response to recognizing the decision as the type to which the rule applies (for a review, see Weber & Lindemann, 2007). Rule-based modes include the previously documented identity (or role) based decision mode, case-based (or expertise-driven) decision making, as well as decision processes that include habits, social norms, and moral rules of conduct. Identity- or role-based decisions activate a social identity (e.g., as a parent) for which the decision maker has a rule and/or expectations about appropriate behavior (March, 1994). Experts use a typically unconscious recognition-driven or case-based process to make decisions based on similarities with past situations (Klein, 1998; H. A. Simon, 1990).

C. Trait Decision Styles versus State Decision Modes

Importantly, while individuals may exhibit trait-like propensities to rely more heavily on one decision mode than another, mode use is also a state-dependent construct, contingent on decision features (Weber & Lindemann, 2007). Several trait-based measures of chronic decision styles (for a review see Hamilton et al., 2016; Scott & Bruce, 1995) measure the way individuals tend to approach decisions. These existing measures of decision styles assess static, dispositional styles at the level of the individual, and do not allow researchers to quantify variance in decision making styles across contexts or types of decisions. Common sense tells us that although people may have propensities for certain decision styles, there is a great deal of variance in decision mode use across different decisions.

D. Past Research on Decision Modes

Past research has shown that understanding the degree to which decision modes are employed by a decision-maker can help us better explain and predict choices, particularly when decision makers face conflicting motivations or social roles (Krosch et al., 2012). Decision mode use influences pro-environmental decision outcomes: in particular, greater use of a role-based and/or affective decision mode is correlated with increased preference for pro-environmental choices whereas greater use of a calculation-based mode is correlated with decreased preference for pro-environmen-

tal choices (Reeck, Gamma, & Weber, 2022). Further, decision mode use can be experimentally manipulated, and interventions that increase the use of role-based decision modes increase subsequent pro-environmental decisions, including weatherization and green energy rate selection (Reeck et al., 2022).

E. The Current Research

This paper presents the results of three studies conducted to develop and validate our Decision Modes Scale (DMS).¹ We followed standard scale development procedures (Flake et al., 2017; Simms, 2008; Worthington & Whittaker, 2006). Table 1 presents an overview of the analyses conducted at each phase of the scale development process, and in which study each analysis was conducted. Study 1 was both substantive and structural, refining decision modes constructs, developing items, and then using exploratory factor analyses to evaluate scale items, finalize the factor structure, and develop a preliminary scale. Studies 2 and 3 addressed the structural phase, using confirmatory factor analysis to test the model fit for this scale. Study 3 assessed convergent and discriminant validity and test-retest reliability.

I. Overview of Participants and Decisions

We used a mix of online and student samples to validate the scale for respondents across a wide range of demographic characteristics (Table S27).

Decision mode use can be expected to differ across different decisions (Ames et al., 2005), so we created the scale using seven decisions that spanned different domains, including public policy, consumer purchase, relationship, and ethical choices (Table S1).

II. Study 1: Item generation, selection, and exploratory factor analysis

In Study 1 we expanded upon the existing three-factor (calculation, affect, role) environmental-specific decision modes scale by Reeck et al. (2022) in

¹ Data and supplemental materials available at <https://osf.io/uvzkk>

two ways. First, we explored multiple types of rule-based decision strategies and second, we constructed the items in a more domain-general way across four different decisions, described below.

1. Methods

a) Item development

Building upon a pilot study that had tested 39 decision mode items (SI), we omitted 12 inadequate items from the pilot and added 21 items that represented a broader range of rule-based decision modes for a total of 50 decision strategy items (Table S5).

b) Procedures

Participants ($N = 1,607$) were recruited and paid via Amazon Mechanical Turk and randomly assigned to one of four decisions. After reading the decision description, participants reported their decision and wrote a few sentences explaining it. Participants then rated their likelihood to use each of 50 decision strategies on a 1 (“not at all likely”) to 7 (“very likely”) scale: “In making this decision in real life, how likely would you be to use each of the strategies listed below? There are no right or wrong answers; focus on what you naturally or typically do or would do.” The four decisions were either environmental (whether to support a revenue neutral carbon tax), relationship (whether to break an important engagement with a romantic partner to help a friend move), moral (whether to report a stealing colleague to your supervisor), and consumer (whether to purchase an LED or a halogen lightbulb) choices. Participants then rated item clarity for a subset of nine randomly selected decision strategies by rating how confusing they thought other respondents would find the item, and finally answered demographics questions.

c) Analysis

We retained 1,161 respondents for analysis (see SI) and followed standard scale development procedures to develop the factor structure and reduce the number of items (Flake et al., 2017; Simms, 2008; Worthington & Whittaker, 2006), namely Horn’s parallel analysis to implement a common factor analysis to determine the number of factors to extract,

and exploratory factor analysis to determine the loadings of the items on each factor (Dinno, 2018; Worthington & Whittaker, 2006). Exploratory factor analyses used the “stats” package in R (R Core Team, 2019), using oblique rotation because our definition of decision modes allows use of multiple decision modes simultaneously, and thus different decision mode factors are likely to be correlated. Initial parallel analysis and factor analysis were conducted for each decision, and items that loaded on one or fewer decisions dropped. We finalized the factor structure by examining the similarity of a parallel analysis and exploratory factor analysis conducted separately on each decision and dropping factors that included two or fewer items.

After finalizing the factor structure, additional analyses reduced the number of items in the scale. To be conservative in item removal, we marked items that were marginal on the criteria below and any items where the retained item was less clearly superior to the dropped item as “reserve” to include as backup items in Study 2. First, we compared the factor loading matrix across the four decisions to look for (1) consistent loading above 0.40 and (2) cross-loading, defined as any item that loads on at least two factors where the difference in loading between two factors is less than 0.15 in magnitude. Second, we looked at clarity ratings. We dropped items that were rated as confusing by at least 10% of respondents on all decisions. Third, we looked for item pairs with unusually high (>.85) inter-item correlation and fourth, factor reliability below .70. Fifth, we looked at syntactic similarity, dropping any items that had very similar wording.

From the remaining list of qualified items, we developed a tentative scale, selecting four items for each factor that would provide as general a meaning as possible.

2. Results

The complete results of each of the phases of factor structure and item removal are presented in the SI. Parallel analysis and exploratory factor analysis identified six consistent, interpretable factors across the four decisions (Table S6, S9, S26).

3. Discussion

In Study 1, we found consistent support for six decision modes across a range of different decision types. These decision modes were calculation, affect, social norms, habitual, identity, and moral. The last four factors each represent distinct elements of the construct of a rule-based decision mode. These factors are robust across decisions and conceptually meaningful descriptions of decision modes.

III. Study 2: Confirmatory factor analysis

The purpose of preregistered Study 2 was to conduct a confirmatory factor analysis to validate the factor structure identified in Study 1 (<https://osf.io/uvzqx/>). We hypothesized that the 24 items would load onto the six factors specified in Study 1.

1. Methods

This online study was conducted with 303 students at a large western public university. Students participated in exchange for course credit. The 303 respondents exceeds the 240 needed for a 10:1 item to participant ratio (Worthington & Whittaker, 2006). Participants saw a decision about whether to support a new student fee that would fund electric campus buses to replace the existing diesel buses. Participants made their choice and then rated their likelihood of using each of the 24 decision strategies identified in Study 1, plus the additional 10 reserve decision strategies, followed by demographic information.

Nineteen students gave the same rating for all decision mode items (“straightlined”) and were excluded from analysis, leaving 284 respondents.

Confirmatory factor analyses used the lavaan package in R (Rosseel, 2012) to test whether the six-factor solution was a good fit to the data. We did not constrain the covariance of the factors in these models, consistent with our theoretical definition of decision modes as not mutually exclusive (Table S12).

2. Results

A confirmatory factor analysis revealed adequate model fit ($\alpha^2(237) = 498.52$, CFI = 0.905, RMSEA = 0.068, SRMR = 0.084; Table S26). Model-derived standardized covariances are shown in Table 2.

3. Discussion

The confirmatory factor analysis of Study 2 showed that the hypothesized six-factor, 24-item scale had sufficient model fit, with items loading strongly on each factor and factors exhibiting satisfactory reliability.

IV. Study 3: Validity and reliability assessment

The purpose of Study 3 was twofold. Structurally, we confirmed the model fit with additional decisions (reported in the SI). For external validity, we established the test-retest reliability and the convergent and discriminant validity of our decision modes instrument, to further demonstrate that our scale provides a robust, meaningful, and distinct contribution to the decision-making literature.

Past research on decision styles has focused on trait-based decision styles, rather than state-dependent, decision-contingent decision modes (Hamilton et al., 2016). To our knowledge, there are no other state-dependent measures of decision-making against which to compare our scale. We expect that decision mode use is somewhat influenced by these chronic, trait-based decision styles, in addition to state-based influences from the features of the decision and its context. Therefore we expect our scale to be moderately correlated with these chronic decision styles measures, identified from the Decision Making Individual Differences Inventory (Appelt et al., 2011) and a literature search for scales that measured decision making processes or cognitive styles directly related to decision making processes, identifying six decision styles measures (Table S13).

We assessed test-retest reliability by examining participants' ratings over time for the same decision. To examine the criterion validity of the DMS, we conducted exploratory analyses to examine the extent to which decision mode use predicts choice (Krosch et al., 2012; Reeck et al., 2022).

1. Methods

This study, preregistered on OSF (<https://osf.io/uvzqx/>), involved two parts, completed two to four weeks apart, by U.S. residents through the online survey platform Prolific Academic. 252 U.S. residents completed part one of this study to provide a 10:1 ratio of respondents per item (Worthington & Whittaker, 2006), plus 10 pretest participants.

Participants completed the 24 item decision modes scale developed in Study 2 for two different decisions at Time 1. The first decision was a peacekeeper decision adopted from Krosch et al. (2012). The second decision was the carbon tax decision from Study 1 (Table S1).

The instructions were unchanged from Study 1. At Time 1, participants completed additional scales, including: the rational and intuitive subscales of the DSS ($\alpha = .86$ for each subscale, 10 items, e.g., “I prefer to gather all the necessary information before committing to a decision”); the dependent ($\alpha = .77$), avoidant ($\alpha = .90$), and spontaneous ($\alpha = .86$) subscales of the GDMS (15 items, e.g., “I often procrastinate when it comes to making important decisions,” “I often make quick decisions”); the NFC ($\alpha = .91$; 8 items, e.g., “I would prefer complex to simple problems”); Maximization ($\alpha = .51$; 6 items, e.g., “No matter how satisfied I am with my job, it’s only right for me to be on the lookout for better opportunities”); two single-item measures of rational and intuitive decision styles (2 items, “I rely on logic and reasoning when making decisions,” “I trust my feelings when making decisions.”); and all five subscales of the MFQ, including harm ($\alpha = .69$), fairness ($\alpha = 0.66$), ingroup ($\alpha = .73$), authority ($\alpha = .75$), and purity ($\alpha = .85$; 30 items, e.g., “Whether or not someone suffered emotionally,” “When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.”). At Time 1, participants provided demographic information.

Two weeks later, Time 1 participants were invited to complete the DMS a second time after making only one (the peacekeeper) decision, to assess test-retest reliability (Watson, 2004). 231 participants completed Part 2 of the study between two and four weeks after Time 1.

At Time-1 we retained 239 participants for analysis who passed the attention check, did not “straightline,” and took more than 5 minutes 34 seconds to complete the study, as preregistered (Curran, 2016; Huang et al., 2012). At Time-2, we retained 214 of 231 participants based on the same preregistered criteria.

Analysis methods for the confirmatory factor analysis were unchanged from Study 2. As preregistered, we conducted analyses with both a 5- and 6-factor scale and found that the 6-factor scale showed sufficient model fit (SI).

To assess convergent and discriminant validity, we conducted Bonferroni-corrected pairwise correlations between subscales. We calculated decision modes subscale scores as the average of the four items in each subscale, on a 1 to 7 scale. We further explored alternate ways to score the decision modes scale to minimize acquiescence bias, as described in the SI.

2. Results

a) Convergent and discriminant validity

Table 3 displays the correlations between the decision mode scores and the other scales for the peacekeeper decision, with similar results for the carbon tax decision (Table S18). Observed correlations are largely consistent with our preregistered hypotheses (in black bold text). As predicted, calculation mode use was significantly positively correlated with the single item rational and the DSS rational subscales, with no significant correlations between the single item intuitive, DSS intuitive, or GDMS spontaneous subscales, respectively. We failed to find the expected significant positive correlation between the NFC and Maximization scales and calculation mode use, however. Affect mode use was significantly positively correlated with the single item intuitive scale and the DSS intuitive and GDMS spontaneous subscales, and no significant positive correlations between the single-item rational measure (these were significantly negatively correlated), NFC, Maximization, or the DSS rational subscale.

Among the other four modes, habitual mode use was directionally consistent but not significantly correlated with the MFQ authority subscale. Social norms mode use was significantly correlated with the GDMS dependent subscale and the MFQ authority subscale scores, but not with the MFQ ingroup subscale. Use of both the identity and moral modes were significantly positively correlated with the MFQ harm and fairness subscales. The use of identity mode was directionally but not statistically correlated with the MFQ purity subscale (Table 3).

b) Between-decision variance and test-retest reliability

Participants' mode use on the peacekeeper decision correlates with participants' mode use on the carbon tax decision, but there is also considerable variation in mode use (Table S24).

We compared responses for the peacekeeper decision between Time-1 and Time-2. 93% of respondents made the same decision at both times, and correlations between Time-1 and Time-2 mode use were equal to or greater than $r = .50$, as predicted.

c) Criterion validity

We explored whether mode use predicted choice, using a series of binomial regression models (Table S25) for the peacekeeper decision. Each mode predicts choice (Model 1). Mode ratings from the other decision, the tax decision, do not significantly predict choice for the peacekeeper decision (Model 2), and Time-1 mode use predicts Time-1 choice controlling for Time-2 mode use ratings (Model 3). Mode use also predicts choice controlling for the trait-based decision scale measures (Model 4). These results demonstrate that respondents' decisions meaningfully covary with the decision modes that they report using, suggesting that these decision mode ratings can provide a meaningful way to understand how decision processes influence choice.

3. Discussion

This study confirmed the acceptable model fit of our six-factor scale from Study 2 for two additional decisions. The six decision modes were related to, but distinct from, existing measures of trait-based decision styles, cognition, and moral foundations. While we failed to find that use of the calculation mode is correlated with cognitive styles NFC and Maximization, we do find that calculation and affect modes are correlated with decision styles measures of logical and intuitive decision styles, respectively. We found convergent validity between our social norms, identity, and moral modes and the MFQ: the foundations of harm and care are associated with both the identity and moral mode use, and the social norms mode use is associated with the authority foundation.

We confirmed our conceptual definition of decision modes as being informed by individual states and decision features, but also informed

by individual habits and traits: there was some stability but also considerable variance in participants' reported use of decision modes across different decisions and over time. For context, the amount of intertemporal stability we observe in decision modes is roughly equivalent to the amount of intertemporal stability observed in the Positive and Negative Affect Schedule Scale, another state measure of momentary or time-specific emotion (Watson, 1988). We found that decision mode use predicted choice for both Study 3 decisions.

F. Conclusion

The reported studies developed the Decision Modes Scale (DMS), a 24-item scale to measure six identified decision modes: calculation, affect, habitual, social norms, identity, and moral decision modes. The final four decision modes are all instances of rule-based decision processes where a decision is based on learned, socially derived heuristics and conventions.

This research makes two main theoretical contributions. First, we expand on the idea of context-dependent decision modes and provide a validated measure of decision mode use. Second, we expand the number of decision modes from three (calculation, affective, and rule-or role-based) to include additional subcategories of rule-based decision modes: social norms, habitual, identity, and moral.

Future research can address limitations of this study. While the current scale was designed to be domain-general, it may predict some types of decisions better than others. Future research can also refine the nature of the relationship between modes, e.g., between calculation and affective modes and the four rule-based modes. Finally, future research is needed to validate this scale with more diverse populations.

The fundamental limitation of this research is the use of self-report to measure decision modes: do people have accurate introspection into their decision processes to answer these questions? We know that self-reports of decision processes and their influences have limitations (Ericsson & Simon, 1980; Pronin & Kugler, 2007). Nevertheless, a wide range of decision research suggests that self-report data is valuable (Chan, 2009). We believe that an imperfect measurement of these constructs can advance research in this area and pave the way for different measurement approaches, e.g., neuroimaging methods that capture the relative influence of different considerations during decision making (e.g., Hutcherson et al., 2015).

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Tables

Table 1: Overview of Scale Development Phases

Phase	Analysis	Study
Substantive	Item development	1
Substantive	Exploratory factor analysis	1
Structural	Item reduction	1
Structural	Confirmatory factor analysis	2 & 3
External	Convergent and discriminant validity	3
External	Test-retest reliability	3
External	Measurement invariance	1 & 2 & 3

Table 2: Standardized Covariances of Study 2 Factors

Factor	Affect	Calculation	Identity	Habitual	Social Norms
Calculation	-.03				
Identity	.61	.44			
Habitual	.69	.09	.51		
Social norms	.51	-.09	.11	.65	
Moral	.15	.77	.60	.37	.14

Table 3: Decision Mode Correlation with Existing Trait-based Scales

Scale	Calculation		Affect		Habitual		Social Norms		Identity		Moral	
	H	r	H	r	H	r	H	r	H	r	H	r
Intuitive 1-Item	0	-0.2	+	.45***		.28**		.07		.31***		.29***
Rational 1-Item	+	.35***	0	-.26*		.06		.01		-.01		.10
NFC	+	.11	0	-.09		-.12		-.25*		.12		.19
Maximization	+	-.07	0	.09		.05		.10		-.03		-.07
DSS: Rational	+	.44***	0	-.15		.04		-.13		.14		.30***
DSS: Intuitive	0	-.13	+	.53***		.27**		.20		.21		.12
GDMS: Spontaneous	0	-.07	+	.32***		.24*		.18		.09		.01
GDMS: Dependent		.11		.00	+	.05	+	.23		-.06		.05
GDMS: Avoidant		-.17		.03		.01		.13		-.15		-.23
MFQ: Harm		-.04		.30***		.08		.00	+	.26**	+	.37***
MFQ: Fairness		.07		.29***		.15		.00	+	.36***	+	.42***
MFQ: Ingroup		.03		.14	+	.21	+	.12		.07		.09
MFQ: Authority		.01		.04	+	.21	+	.32***		-.06		-.04
MFQ: Purity		.06		.22		.20	+	.08	+	.14	+	.15

Note. Correlations are provided for the peacekeeper decision. Bold, black font indicates preregistered hypotheses (the direction of the hypotheses is indicated by the + or 0 in H labeled columns). Correlations use Bonferroni correction. * $p < .05$, ** $p < .01$, *** $p < .001$.

Appendix: Decision Modes Scale Administration and Analysis

In making this [optional description] decision in real life, how likely would you be to use each of the strategies listed below? **There are no right or wrong answers; focus on what you naturally or typically do or would do.**

1 Not at all likely / 2 / 3 / 4 / 5 / 6 / 7 Very likely

Item	Wording [randomize presentation order]	Decision mode [For scoring, not displayed]
A1	Follow your gut feelings	Affect
A2	Trust your immediate emotional reactions	Affect
A3	Act based on how you feel now	Affect
A4	Follow your heart	Affect
C1	Consider the overall costs and benefits	Calculation
C2	Weigh potential benefits against risks	Calculation
C3	Analyze all the options and pick the overall best	Calculation
C4	Work out the different pros and cons of each option	Calculation
I1	Act in a way that is consistent with your identity	Identity
I2	Be true to yourself	Identity
I3	Be true to your values	Identity
I4	Do what is consistent with who you are	Identity
M1	Do what is fair	Moral
M2	Do the “right” thing	Moral
M3	Consider what will do the most good	Moral
M4	Think of the greater good	Moral
H1	Do what you always do when in this situation	Habit
H2	Follow what you’ve done in the past	Habit
H3	Assess similarity to prior situations and make the same decision	Habit
H4	Decide based on what you’ve done in similar situations	Habit
S1	Do what others are doing	Social norms
S2	Do what other people think is the right thing to do	Social norms
S3	Follow social norms	Social norms
S4	Do what people expect you to do	Social norms

Scoring. Compute six separate mode use scores by averaging respondent scores on the four mode items.

Analysis. As decision mode use can covary, we recommend analyzing mode use while controlling for use of other modes. See Supplementary Materials for preliminary instructions for alternate administration and scoring if conducting analyses with only one mode.