



# Military maximizers: Examining the effect of individual differences in maximization on military decision-making

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## ABSTRACT

The present study investigates the role maximization plays in explaining individual differences in decision-making in high-uncertainty situations. There is a wealth of evidence that maximization affects decision-making, yet the types of decisions that have been studied have been consumer-focused. Despite the known importance of maximization, the boundaries of maximization have not been explored. This research extends the study of maximization by evidencing that individual differences in maximization influence decision-making with a sample of military personnel ( $n = 287$ ) when they make both military (domain specific) and non-military (domain general) decisions. Furthermore, taxometric analysis allowed the researchers to explore the latent structure of maximization, identifying that it can also be conceptualized as a categorical (rather than a traditionally continuous) variable. Overall, high maximizers found decisions more difficult, were slower to choose an option and decide. These findings are in accord with a wealth of previous research on the effects of maximization, but demonstrate that the effect of maximization extends to applied decision-making with applied samples who make decisions in high-uncertainty situations. These findings have important theoretical implications for the study of maximization and the study of decision-making under uncertainty, as well as applied implications for issues such as personnel selection.

## 1. Introduction

“A good plan violently executed now is better than a perfect plan executed next week.”

George S. Patton

As emphasized in the famous George S. Patton quote above, effective military decision-making involves balancing the time taken to reach a decision and the degree to which it is “ideal” (Clairoux, Gareau, Thibault, Vezina, & Walker, 2002). Accordingly, naturalistic research (research observing decision-making in the field, Klein, 1989) has identified that individuals, including members of the Armed Forces (Pascual & Henderson, 1997; Shortland & Alison, 2019), can suffer from delays in decision-making driven by redundant efforts to find a “ideal” solution (referred to as “redundant deliberation,” Power & Alison, 2018) when making high-uncertainty decisions in which there is no clear “ideal” choice. Effective military decision-making is therefore centered on the ability to *satisfice*, rather than *maximize*, within a given situation. Maximization is the individual-level predictor of tendencies to expend cognitive energy searching through many possible

alternatives with the goal of finding the optimal outcome (Schwartz et al., 2002). Experimental research has found that people who consistently try to maximize their decisions are more prone to procrastination (Osiurak et al., 2015), and more likely to engage in counterfactual thinking (Schwartz et al., 2002). Despite (1) the potentially negative implications of seeking maximization in military and other high-uncertainty decisions, and (2) the known negative effects of maximization on decision-making (see Cheeks & Schwartz, 2016) to date, there has been no investigation of the effect of maximization on decision-making in military scenarios.

### 1.1. Maximization

Dar-Nimrod, Rawn, Lehman, and Schwartz (2009) argues that individual differences in maximization moderate the “paradox of choice” in which people are attracted to larger assortments, but often dissatisfied with their eventual choice (see also Schwartz, 2004). Maximization differentiates people based on their tendency to approach choices with the goal of finding the “best” possible option vs., satisficing for an option that is “good enough” according to their own

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threshold of acceptability (Schwartz, 2004). Extensive literature has found both different decision-making strategies and decision-making outcomes between maximizers and satisficers. Maximizers are more likely to report low self-esteem overall (Schwartz et al., 2002), lower levels of happiness (Polman, 2010; Schwartz et al., 2002) and are less likely to be satisfied with their lives (Dahling & Thompson, 2012; Schwartz et al., 2002). Maximizers are also more prone to regret (Besharat, Ladik, & Carrillat, 2014; Moyano-Díaz, Cornejo, Carreño, & Muñoz, 2013; Parker, Bruine de Bruin, & Fischhoff, 2007), more of a perfectionist (Bergman, Nyland, & Burns, 2007; Chang et al., 2011; Dahling & Thompson, 2012; Schwartz et al., 2002), less optimistic (Schwartz et al., 2002), greedier (Seuntjens, Zeelenberg, van de Ven, & Breugelmans, 2015), and more neurotic than satisficers (Purvis, Howell, & Iyer, 2011; Schwartz et al., 2002). Maximizers are less open (Purvis et al., 2011), less happy (Larsen & McKibban, 2008; Polman, 2010; Purvis et al., 2011; Schwartz et al., 2002), have lower overall life satisfaction (Chang et al., 2011; Dahling & Thompson, 2012; Schwartz et al., 2002), more prone to procrastination (Osiurak et al., 2015), and are more likely to engage in counterfactual thinking (Schwartz et al., 2002). Based on the extensive literature above (see also Cheeks & Schwartz, 2016), there is ample evidence that maximizers prefer different type of decisions (i.e., those with high numbers of possible alternatives), engage in different types of decision-making (rational-cognitive) and ruminate differently on the choice after it has been made. Maximization is, in this sense, an incredibly important and central psychological variable at the heart of individual differences in decision-making (see Cheeks & Schwartz, 2016).

Given the wealth of evidence for the role of maximization in decision-making, it is interesting to note that, to date, the types of decisions that have been studied have been relatively mundane and consumer-focused (Kokkoris, 2019). Decisions related to consumer goods have been extensively studied in the maximizing literature (e.g., Diab, Gillespie, & Highhouse, 2008; Kokkoris, 2018; Weaver, Daniloski, Schwarz, & Cottone, 2015). However, despite the importance of maximization as a “everyday trait,” the boundaries of maximization have not been explored. Kokkoris (2019) recently explored the domain specific nature of maximization, and here too maximization warrants further study in order to understand, for example, if the effects of maximization extend to high-stress decisions, decision involving uncertainty, or decisions involving time pressure. This extension of the study of maximization is especially important given that decision-making in uncertain environments can become derailed by the inability to satisfice (Alison et al., 2015; Shortland, Alison, & Moran, 2019; van den Heuvel, Alison, & Crego, 2012). This research extends the investigation of the effect of maximization to more high-uncertainty environments.

### 1.2. Military maximizers

Under extreme levels of physiological and psychological strain, members of the Armed Forces wrestle with uncertainty, complexity, time pressure and accountability in order to operate within a set of strategic, ethical and legal boundaries. The Military Decision-Making Process is the rational-methodological tool used by military personnel to solve tactical problems and make military plans and represents the Army's formal methodology for making tactical decisions (Burwell, 2001). When followed correctly it should “lead to the best (or at least a better) decision given the degree of uncertainty and complexity of the situation” (Allen & Gerras, 2009). The problem, however, is that often in military situations, there is no best option, and instead they much choose the least-worst (Shortland & Alison, 2019). Least-worst decision-making invites maximization because at the time of the decision, there is no clear understanding of what the *right* decision is (Shortland et al., 2019). Current research on least-worst decisions (in a military and non-military context) has taken three forms. Firstly, research has observed the occurrence of least-worst within real (or simulated) decision-

making (Alison et al., 2013, 2014; Alison et al., 2015; Power & Alison, 2017; van den Heuvel et al., 2012; Wilkinson, Cohen-Hatton, & Honey, 2019). Secondly, research has interviewed decision-makers about the process of least-worst decision-making to identify exogenous and endogenous sources of uncertainty that influence the least-worst decision-making process (Shortland et al., 2019; van den Heuvel, Alison, & Power, 2014). Finally, researchers have proposed the role of competing goals/priorities and/or sacred values as a central issue when making least-worst decisions (Power & Alison, 2018; Shortland & Alison, 2019). To date, no research as explored the role of individual differences in least-worst decision-making, and given that naturalistic research emphasizes the urge to maximize and find the “best” solution; investigating the role of individual differences in trait maximization is an essential starting point.

In line with previous literature then, we hypothesize that Maximizers will find military decisions more difficult (H<sub>1</sub>). Furthermore, because maximizers engage in excessive information processing (Dar-Nimrod et al., 2009; Iyengar, Wells, & Schwartz, 2006; Nenkov, Morrin, Ward, Schwartz, & Hulland, 2008; Polman, 2010), which may be a sign of redundant deliberation; Alison et al., 2013; Shortland & Alison, 2019) Maximizers will be slower to decide (H<sub>2</sub>). Finally, in accordance with Parker et al. (2007), who found that maximizers display problematic decision-making styles, including more avoidant decision-making, we hypothesize that Maximizers will be more likely to make choices that reflect tendencies of avoidance (H<sub>3</sub>). To investigate the domain-specific boundaries of maximization this research will also compare the effect of maximization in domain-specific (military) and domain-general (non-military) decisions (see Kokkoris, 2019).

## 2. Method

### 2.1. Participants

Participants are a sample of 293 individuals recruited from army bases in both the United States ( $n = 234$ ) and United Kingdom ( $n = 59$ ). Participants who reported scores that were outside of the specified range for each of the scales used (indicative of missed questions) were removed from analysis ( $n = 6$ ). This resulted in a total loss of approximately 2.05% of participants, leaving 287 (79.79% male) participants, with an age range of 18 to 60 ( $M = 32.53$ ,  $SD = 7.91$ ). Data was collected in person by the research team and the study was administered on an iPad computer or personal computer via Qualtrics. All participants were serving as active members of the Armed Forces when they completed this study. Recruitment to United States Armed Forces personnel was facilitated by the United States Army Research Institute Foundational Science Research Unit in support of a wider study on the antecedents of individual differences in military decision-making.

### 2.2. Materials

#### 2.2.1. Maximization

Here we employ Turner, Rim, Betz, and Nygren's (2012) 34-item Maximization Inventory, which is measured using a 6-point scale ranging from “Strongly Disagree” (1) to “Strongly Agree” (6). This scale measures three components of maximization: satisficing (10 items), decision difficulty (12 items), and alternative search (12 items). Satisficing measures the tendency to make choices that reach a threshold of “acceptability,” rather than focusing on finding the optimal solution, within a given scenario; the satisficing subscale includes items like “I usually try to find a couple of good options and then choose between them,” and “I can't possibly know everything before making a decision.” Decision difficulty measures an individual's level of frustration—or difficulty—in making choices and includes items like “I usually have a hard time making even simple decisions” and “It's hard

for me to choose between two good alternatives,” while also including reverse-coded items such as “I do not agonize over decisions.” Alternative search measures tendencies to seek out and review all available options and includes items like “I take time to read the whole menu when dining out” and “When shopping for something, I don't mind spending several hours looking for it.”

2.2.2. Decision-making

The research procedure (LUCIFER; see below) provides the following dependent measures (both on average across the scenarios, and per scenario):

1. Situational Awareness Time (SAT): The amount of time it took the participant to listen to the audio feed outlining the situation and the decision and declare (by progressing onto the next page) that they were “ready” to decide.
2. Choice time (CT): The amount of time it took a participant to “choose” an option. This is measured as the amount of time until they recorded their last “click” on an option on the page (Qualtrics recorded both first and last page clicks for each step of the scenario).
3. Decision Time (DT): The overall time it took the participant to choose a course of action and commit and declare they are ready to “commit” to their choice.
4. Commitment Time (ComT): ComT is the time lag between selecting a course of action (CT) and committing to it (DT). ComT, therefore, reflects a period of indecision between selecting a course of action and committing to it. In terms of calculation, simply, ComT = DT – CT.
5. Decision Difficulty (DD): Participants completed a five-item decision difficulty scale (as employed by Hanselmann & Tanner, 2008) after completing each scenario. These items ask the participant to answer on a 7-point scale. Items include “For me this decision is...” with responses ranging from “very easy” (1) to “very difficult” (7). For the remaining items, participants are asked to rate their level of agreement (“strongly disagree” [1] to “strongly agree” [7]) for statements like “I would need more time to decide.”
6. Approach/Avoidance (AA): Each decision presented offered participants a choice between an Approach decision (actively seeking to make a positive impact) and a avoidance decision (withdrawing and preventing further harm; see Power, 2018). A overall approach/avoidance (AA) score was calculated by summing the total number of avoidance choices made across all scenarios.

As part of the wider research project, Need for Closure (NFC) is also being measured. NFC is the desire to obtain a definite answer to a topic or question, rather than experience confusion and ambiguity (Kruglanski, 1989, p.14). In this study, NFC was measured via the ‘Need for Cognitive Closure Scale’, which is a five-facet scale that measures preference for order, preference for predicatability, decisiveness, discomfort with ambiguity, and closed-mindedness (see Kruglanski, Webster, & Klem, 1993, for a full outline of the measure). Individual differences in NFC score are controlled for through the analysis, and the effect of NFC on military decision-making shall be published separately.

2.3. Procedure

All participants completed the psychometric battery via either computer or tablet, with informed consent provided digitally prior to beginning the study. Participants were also reminded of their ability to end testing at any time, and participants were supervised by a test proctor through their testing and were asked to complete the battery in a single session.

2.3.1. Decision-making task (LUCIFER)

LUCIFER adopts a 2-alternative forced choice (2AFC) approach in which individuals are presented with an audio-feed (recorded by

members of the armed forces, or paid actors) that provide them an assessment of the situation and a required action. All feeds and responses are conducted on an Apple iPad and delivered via Qualtrics to allow accurate recording of response times. LUCIFER has been developed with support from ARI FSRU, the Combat Capabilities Development Command (CCDC) Soldier Center at Natick and the Center for Applied Brain and Cognitive Sciences at Tufts University and has been piloted with a range of applied groups (Soldiers, Police Officers, Fire fighters, etc.). LUCIFER scenarios are developed from critical decision-making interviews with Soldiers, Police and Fire officers (see Shortland et al., 2019; Shortland & Alison, 2019) and delivered via recorded audio feed with corresponding background noise:

*“Hi Commander, there has been an explosion in Merseyside tunnel we have deployed the Police and Fire Services there now to help with evacuations and casualties. The problem is that we're hearing rumors that there is a secondary bomb in the tunnel which could go off at any time. We don't have a lot more information on the source, except the security services say it is a ‘credible threat.’ Do you want to call the officers out of the tunnel?”*

After being exposed to this audio input participant choose their course of action (I will not evacuate the tunnel vs., I will evacuate the tunnel) and their confidence level. After the participant has indicated their decision, a second inject occurred that tested their commitment to this course of action. In the example above, if the participant did choose to deploy air support (choices 1–5) the following inject was delivered:

*“Sir, one of the officers is refusing to come out of the tunnel. He says he is with an 8 year-old girl who is trapped. Her mum is dead but she's only pinned in by some metal. He needs some pedal cutters to get her out and he won't come out until he's got those cutters. Some of the other officers have volunteered to go back with the cutters. Shall I let them go?”*

Again, after being exposed to this audio input the participant is asked to choose their course of action (I will send in pedal cutters vs., I will not send in pedal cutters), their confidence level, and completes the decision difficulty questionnaire (Hanselmann & Tanner, 2008). All scenarios have been piloted with a non-applied sample (undergraduate students to ensure they are comprehended by lay persons as well as experts). LUCIFER involves 7 military scenarios and 5 non-military scenarios.

3. Results

3.1. Overall performance

Participants took, on average, 30 s to understand the situation and declare themselves “ready” to decide ( $M = 27.42, SD = 92.06$ ; See Table 1). Participants took just under 7 s to decide on average ( $M = 6.83, SD = 8.07$ ). It then took them just over 1 s on average to

Table 1  
Descriptive statistics.

Variable	Mean	St. deviation	Minimum	Maximum
Outcome variable (N = 2870)				
Situational awareness time (SAT)	27.42	92.06	0.27	47.00
Decision time (DT)	6.83	8.07	0.23	138.70
Choice time (CT)	5.41	7.30	0.00	134.30
Commitment time (ComT)	1.42	2.54	0.00	47.72
Decision difficulty (DD)	15.20	6.87	0.0	26.0
Approach/avoidance score (AA)	4.67	1.27	1	8
Individual level variables (N = 287)				
Need for closure score (NFC)	47.13	9.11	17.00	75.00
Maximization score (MAX)	116.20	13.90	82.00	174.00
Scenario level variables (N = 10)				
Military scenarios	6			

commit to this decision ( $M = 1.42, SD = 2.54$ ). In terms of decision difficulty, on average, scenarios were viewed as having a medium level of difficulty ( $M = 15.2, SD = 6.868$ ).

### 3.1.1. Maximization

Overall, participants' Maximization scores ranged from 82.0 to 174.0 ( $M = 116.20$ ). The Maximization scale also measures three subscales: Satisficing ( $M = 43.10, SD = 5.71$ ), Decision Difficulty ( $M = 32.87, SD = 7.23$ ), and Alternative Search ( $M = 40.28, SD = 8.28$ ). Preliminary analyses included a series of Pearson's correlations that indicated that Maximization had a significant correlation with each of the input variables in the models. Maximization was positively correlated with situational awareness time ( $r = 0.040, n = 287, p = .034$ ), commitment time ( $r = 0.074, n = 287, p < .0001$ ), choice time ( $r = 0.068, n = 287, p = .0002$ ), decision time ( $r = 0.085, n = 287, p < .0001$ ), and decision difficulty ( $r = 0.045, n = 287, p = .017$ ). Maximization was also found to be negatively correlated with tendency to approach ( $r = -0.057, n = 287, p = .002$ ).

### 3.1.2. Multi-level models

Multi-level modelling (MLM) tested the effect of Maximization on decision-making while controlling for NFC and other variables. Multi-level modelling for each of the dependent variables organized the total 2870 data points both by the random effects of the ten scenarios and by the 287 participants. Using this structure, a two-level MLM was used to estimate the main effect of Maximization on SAT, DT, CT, ComT, DD and AA (see Table 2). The outcome of these MLMs is displayed below in

**Table 2**  
Multilevel linear regressions for preference and difficulty scorings with crossed-random effects.

Models	$\beta$	SE	Odds ratio [Exp( $\beta$ )]	p
1. Situational awareness ( $N = 2795$ )				
Constant	20.100	4.371	5.360 * 10 <sup>0</sup> 000***	
Need for closure score (NFC)	0.018	0.204	1.018	.929
Maximization score (MAX)	0.259	0.134	1.295	.053
Military scenario (Yes = 1)	12.130	5.639	1.854 * 10 <sup>5</sup> 032*	
2. Decision time ( $N = 2870$ )				
Constant	7.343	1.037	1545.372	.000***
Need for closure score (NFC)	-0.053	0.03	0.948	.079
Maximization score (MAX)	0.061	0.020	1.063	.002**
Military scenario (Yes = 1)	-0.860	1.307	0.423	.510
3. Choice time ( $N = 2870$ )				
Constant	5.750	0.947	314.049	.000***
Need for closure score (NFC)	-0.038	0.026	0.963	.141
Maximization score (MAX)	0.044	0.017	1.045	.009**
Military scenario (Yes = 1)	-0.567	1.200	0.567	.637
4. Commitment time ( $N = 2870$ )				
Constant	1.593	0.134	4.921	.000***
Need for closure score (NFC)	-0.015	0.008	0.985	.049
Maximization score (MAX)	0.017	0.005	1.017	.0008***
Military scenario (Yes = 1)	-0.293	0.161	0.746	.069
5. Decision difficulty score ( $N = 2870$ )				
Constant	1.281	0.121		.000***
Need for closure score (NFC)	-0.019	0.016		.222
Maximization score (MAX)	0.051	0.011		.000***
Military scenario (Yes = 1)	0.000	0.000		.999
5. Avoidance score ( $N = 2870$ )				
Constant	4.359	0.024	78.186	.000***
Need for closure score (NFC)	0.001	0.003	1.001	.652
Maximization score (MAX)	-0.002	0.002	0.998	.353
Military scenario (Yes = 1)	0.000	0.001	1.000	.656

Note: a series of models were also run examining interaction effects between Maximization scores and scenario type on each of the outcome variables, but there was no evidence to suggest that there was a significant interaction.

\*  $p < .05$ .  
\*\*  $p < .01$ .  
\*\*\*  $p < .001$ .

Table 2. This provided support for hypothesis 1 and 2. Hypothesis 3 was not supported.

### 3.2. Taxometric analysis of maximization

To determine the latent structure of maximization taxometric analytic methods (*mean above minus below a cut* (MAMBAC; Meehl & Yonce, 1994), *maximum covariance* (MAXCOV; Meehl & Yonce, 1996), and *L-Mode* (Waller & Meehl, 1998)) were used to provide semi-independent evidence about latent structure and a consistency check for assessing each type of distribution. These analyses were executed in R via the 'RTaxometrics' package (Wang & Ruscio, 2017). Each of the three Maximization scales used for all analyses met conventional criteria for indicator validity ( $d > 1.25$ ; Meehl, 1995), which shows the ability between the empirically-generated base rates determined by the Comparison Curve Fit Index (CCFI) analysis. The present study derived estimations of putative taxon base rates from the MAMBAC, MAXCOV, and L-Mode procedures. The mean of these base rates was then used to estimate the boundary between taxon and complement groups, as it has been found to be a superior identifier than the base rates estimated by each of these methods alone (McGrath & Walters, 2012). These respective base rate estimates were then used to create comparison categorical and dimensional curves for the MAMBAC, MAXCOV, and L-Mode analysis methods. When examining the construct of Maximization overall, the average CCFI value for the total sample when using the estimated taxon base rate supports a categorical structure,  $CCFI = 0.556$ . A breakdown of CCFI values for this analysis can be found in Table 3, while a visual comparison of the taxometric procedures may be found in Fig. 1. Based on the results of this taxometric analysis, the sample of 287 Soldiers were re-classified as a binary "high" or "low" maximizers based on the cut-off identified by taxometric analysis and their decision-making was re-analyzed as a between group comparison.

#### 3.2.1. High vs. low maximization

A two-level MLM was used to estimate the main effect of Maximization as a dichotomous variable on SAT, DT, CT, ComT, DD, and AA (see Table 4). Status as a high maximizer significantly increased the odds of having a longer commitment time as compared to low maximizers ( $OR = 1.872, p = .009$ ). For choice time, status as a high maximizer significantly increased the odds of having a longer choice time as compared to low maximizers ( $OR = 5.737, p = .025$ ). For decision time, we see similar results with status as a high maximizer significantly increasing the odds of having a longer decision time as compared to low maximizers ( $OR = 10.097, p = .011$ ). Finally, decision difficulty had much greater odds of being higher when measured during a military scenario ( $OR = 7.494, p < .0001$ ). Similar results can be found when examining the effect of scenario type on tendency to avoid conflict ( $OR = 1.076, p = .010$ ).

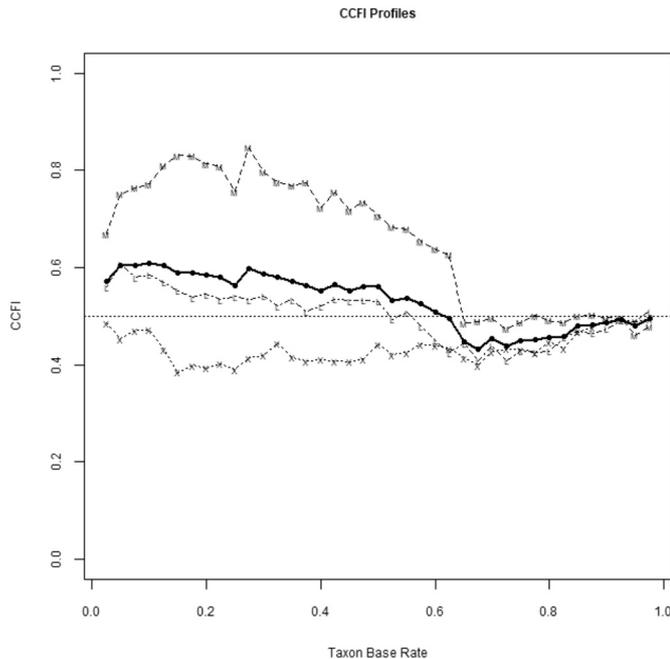
## 4. Discussion

Maximization reflects the individual differences in the tendency to seek to make the best choice (for reviews, see Cheeks & Schwartz, 2016; Misuraca & Fasolo, 2018). This study was the first to systematically examine the role of maximization in an applied sample of individuals when making decisions that involve high-uncertainty, high-cost, and present a series of non-ideal outcomes. High-uncertainty decisions are those in which the outcomes of a certain action are not know, and this sense of doubt can delay action (Lipshitz, Klein, Orasanu, & Salas, 2001). These types of decisions have been extensively studied in naturalistic research and are shown to be especially troubling for practitioners in the field, resulting in negative outcomes such as decision inertia and delays to action (Alison et al., 2013; Alison et al., 2015; van den Heuvel et al., 2012). Given the need, in the face of high-uncertainty decisions, to settle for the "least-worst outcome" (Shortland et al.,

**Table 3**  
CCFI values for maximization generated using empirically-generated base rates.

	Taxon base rate estimate				Comparison curve fit index			
	MAMBAC	MAXCOV	L-Mode	Mean	MAMBAC	MAXCOV	L-Mode	Mean
Total (n = 287)	0.153	0.955	0.062	0.091	0.720	0.440	0.524	0.556

Note: CCFI values < 0.45 are indicative of dimensionality, whereas CCFI values > 0.55 are suggestive of categorical structure; CCFI values that fall in the 0.45–0.55 range are considered inconclusive.



**Fig. 1.** A visual representation of CCFI profiles for Maximization of the MAMBAC, MAXCOV, and L-Mode Taxometric Procedures. Note: CCFI values above the average line are suggestive of categorical structure, while those below the line are suggestive dimensional structure.

2019), maximization could play an important role in explaining individual differences in the ability of decision-makers to commit to courses of action in high-uncertainty events (such as military missions, police operations, Government responses, humanitarian crises etc.).

In line with our hypotheses we found that, in a sample of currently active members of the Armed Forces, trait maximization increased decision difficulty, the amount of time to comprehend the situation and be “ready” to decide, the amount of time taken to select a course of action (when presented with a binary A or B choice), and the amount of time to commit to that course of action. This supports the notion that maximizers are slower to decide, find decisions more difficult and are more avoidant (Kim & Miller, 2017), though is contrary to previous findings that maximizers are more likely to engage in spontaneous decision-making (Parker et al., 2007).

Contrary to our hypotheses, trait maximizers were not more likely to choose avoidant courses of action, and despite participants viewing military scenarios as harder overall, there was no effect of scenario type on the effect of maximization (i.e., trait maximization had a domain general effect on decision-making; Schwartz et al., 2002; Diab et al., 2008; Misuraca, Gangemi, Carmeci, & Miceli, 2015). One reason for this may be the conceptualization of avoidance. In previous research avoidance has been viewed as the tendency to avoid decisions (rather than make decisions that represent an avoidant tendency (Scott & Bruce, 1995)). LUCIFER does not allow the avoidance of decisions. This warrants future research, and indeed clarification in the field as to the degree to which maximizers are avoidant of decisions, when allowed

(often found; e.g., Spunt, Rassin, & Epstein, 2009), rather than choosing an outcome that reflects a avoid choice (defined as “avoiding further harm”; see Power & Alison, 2017).

Overall, these findings provide support for the extension of the study of trait maximization away from just consumer and everyday decision-making and towards consideration of more high-uncertainty, high-stakes decision-making that is often focused on by naturalistic researchers. In addition to this, in this study we used a relatively rare, and hard-to-access sample of members of the Armed Forces. Despite research that shows that they are better than non-military counterparts at making hard decisions (see Shortland et al., 2019), this research supports that they are equally susceptible to the effects of maximization on decision-making.

Of additional interest is the measurement of maximization. There has been significant debate about how maximization is measured. For example, Cheeks and Schwartz (2016) identify eleven different conceptualizations and measurement tools for maximization, that the underlying structure of maximization is often ignored in empirical research. Others have raised issues with the scales used to measure maximization (Dalal, Diab, Zhu, & Hwang, 2015; Misuraca et al., 2015; see Kokkoris, 2019). Here we used taxometric analysis to explore the latent structure of maximization. While our results were not conclusive, but we did identify that in our sample of applied decision-makers, maximization could be conceptualized as a dichotomous variable of high vs., low maximizers, and while there was not an even distribution of high vs., low maximizers within our sample, there were significant differences in their decision-making performance based on a binary maximization classification. Furthermore, as is clear in the comparison of Tables 2 and 4, high maximization only affected decision difficulty scores when the variable was treated as a scale (and not binary). This reinforces the need to further consider the conceptualization of maximization, and perhaps, warrants further replication of previous research exploring the effects of trait maximization.

**CRedit authorship contribution statement**

**Neil Shortland:**Conceptualization, Methodology, Data curation, Writing - original draft.**Laurence Alison:**Conceptualization, Methodology, Supervision, Writing - review & editing.**Lisa Thompson:**Writing - original draft, Data curation, Formal analysis.

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**Table 4**  
Multilevel linear regressions for preference and difficulty scorings with crossed-random effects with maximization as a dichotomous construct.

Models	$\beta$	SE	Odds ratio [Exp(B)]	p
1. Situational awareness (N = 2795)				
Constant	19.782	4.427	3.900 * 10 <sup>8</sup> 000	
Need for closure score (NFC)	0.129	0.200	1.138	.520
Maximization (high scorer = 1)	3.028	6.642	20.654	.639
Military scenario (yes = 1)	12.139	5.657	1.870 * 10 <sup>5</sup> 032*	
2. Decision time (N = 2870)				
Constant	7.130	1.037	1248.284	.000
Need for closure score (NFC)	-0.042	0.030	0.959	.159
Maximization (high scorer = 1)	2.312	0.914	10.097	.011*
Military scenario (yes = 1)	-0.853	1.302	0.426	.512
3. Choice time (N = 2870)				
Constant	5.588	0.948	267.266	.000
Need for closure score (NFC)	-0.030	0.025	0.970	.228
Maximization (high scorer = 1)	1.747	0.779	5.737	.025*
Military scenario (yes = 1)	-0.562	1.196	0.570	.637
4. Commitment time (N = 2870)				
Constant	1.536	0.136	4.644	.000
Need for closure score (NFC)	-0.012	0.008	0.988	.116
Maximization (high scorer = 1)	0.627	0.240	1.872	.009**
Military scenario (yes = 1)	-0.292	0.160	0.747	.069
5. Decision difficulty score (N = 2870)				
Constant	16.015	0.152	9.024 * 10 <sup>6</sup> 000***	
Need for closure score (NFC)	0.002	0.014	1.002	.894
Maximization (high scorer = 1)	-0.000	0.000	1.000	.999
Military scenario (yes = 1)	-0.652	0.104	0.521	.000***
6. Avoidance score (N = 2870)				
Constant	4.784	0.033	119.637	.000***
Need for closure score (NFC)	0.003	0.003	1.000	.919
Maximization (high scorer = 1)	-0.000	0.000	1.000	.999
Military scenario (yes = 1)	0.073	0.029	1.076	.010**

Note: Maximization High Scorers, n = 260; A series of models were also run examining interaction effects between Maximization scores and scenario type on each of the outcome variables, but there was no evidence to suggest that there was a significant interaction.

\* p < .05.  
\*\* p < .01.  
\*\*\* p < .001.

**Appendix A**

*Tunnel scenario*

Hi Commander, there has been an explosion in Merseyside tunnel we have deployed the Police and Fire Services there now to help with evacuations and casualties. The problem is that we're hearing rumors that there is a secondary bomb in the tunnel which could go off at any time. We don't have a lot more information on the source, except the security services say it is a "credible threat." Do you want to call the officers out of the tunnel?

*Second step:*

"Sir, one of the officers is refusing to come out of the tunnel. He says he is with an 8 year old girl who is trapped. Her mums dead but she's only pinned in by some metal. He needs some pedal cutters to get her out and he won't come out until he's got those cutters. Some of the other officers have volunteered to go back with the cutters. Shall I let them go?"

*Mountain fire scenario*

Sarge, Private First Class Billings here. I am here with some Special Forces guys. They say they have intelligence about the base of operations for the local insurgents who have been targeting our base with missiles over the past month. The intel comes from an insurgents' brother. He says they have a base of operations at about 11,000 ft in

some nearby mountains. We've got UAV footage of the area. It's pretty grainy, but there is definitely some movement up there. They are likely to move by morning, so the window is time limited. They are saying this is our chance. Do you want me to mobilize air support?"

*Second step:*

[Call from Squad Commander]. I've just heard from PFC Billings. What the hell are you doing. We are looking at the exact same intelligence as you! Undo your decision right now.

*Rescue mission*

Captain, we have just heard from our guys in the field, they were being dropped by helicopter at a landing sight up in the mountains and they came under heavy fire. They aborted the landing but one of the officers fell out of the helicopter in all the confusion. The status of soldier is unknown. The helicopter has landed in a safe spot on the valley floor but is requesting that they immediately turn around and go back to the landing zone to retrieve their Soldier."

*Second step:*

"We have received a satellite feed from the ground that shows the Landing Zone where the Soldier was last seen. The footage is unclear but appears to show him in and amongst a lot of enemy soldiers. We cannot confirm if he is free and fighting, captured, or has since been killed. The other guys still want to go after him. What do you want to do?"

**References**

Alison, L., Power, N., van den Heuvel, C., Humann, M., Palasinski, M., & Crego, J. (2015). Decision inertia: Deciding between least-worst outcomes in emergency responses to disasters. *Journal of Occupational and Organizational Psychology*, 88(2), 295-321.

Alison, L., van den Heuvel, C., Waring, S., Crego, J., Power, N., Long, A., & O'Hara, T. (2013). Immersive simulated learning environments for researching critical incidents: A knowledge synthesis of the literature and experience of studying high-risk strategic decision-making. *Journal of Cognitive Engineering and Decision-making*, 7(3), 255-272.

Alison, L., Alison, E., Noone, G., Elntib, S., Waring, S., & Christiansen, P. (2014). The efficacy of rapport-based techniques for minimizing counter-interrogation tactics amongst a field sample of terrorists. *Psychology, Public Policy, and Law*, 20(4), 421.

Allen, C. D., & Gerras, S. J. (2009). *Developing creative and critical thinkers*. ARMY COMBINED ARMS CENTER FORT LEAVENWORTH KS.

Bergman, A. J., Nyland, J. E., & Burns, L. R. (2007). Cor-relates with perfectionism and the utility of a dual process model. *Personality and Individual Differences*, 43, 389-399.

Besharat, A., Ladik, D. M., & Carrillat, F. A. (2014). Are maximizers blind to the future? When today's best does not make for a better tomorrow. *Marketing Letters*, 25, 77-91.

Burwell, D. W. (2001). *Logical Evolution of the Military Decision Making Process*. ARMY COMMAND AND GENERAL STAFF COLL FORT LEAVENWORTH KS SCHOOL OF ADVANCED MILITARY STUDIEShttps://pdfs.semanticscholar.org/cb2a/e09cfbfd2c3c396f8077adbaae65a73cad8.pdf.

Chang, E. C., Lin, N. J., Herringshaw, A. J., Sanna, L. J., Fabian, C. G., Perera, M. J., & Marchenko, V. V. (2011). Understanding the link between perfectionism and adjustment in college students: Examining the role of maximizing. *Personality and Individual Differences*, 50, 1074-1078.

Cheeks, N. N., & Schwartz, B. (2016). On the meaning and measurement of maximization. *Judgment and Decision making*, 11(2), 126-146.

Clairoux, G., Gareau, M., Thibault, G., Vezina, G., & Walker, R. S. (2002). ISTAR concept experimentation for Canada's future army. In: *Proc. SPIE 4741, Battlespace Digitization and Network-Centric Warfare II*https://doi.org/10.1117/12.478714.

Dahling, J. J., & Thompson, M. N. (2012). Detrimental relations of maximization with academic and career attitudes. *Journal of Career Assessment*, 21, 278-294.

Dalal, D. K., Diab, D. L., Zhu, X. S., & Hwang, T. (2015). Understanding the construct of maximizing tendency: A theoretical and empirical evaluation. *Journal of Behavioral Decision Making*, 28, 437-450.

Dar-Nimrod, I., Rawn, C. D., Lehman, D. R., & Schwartz, B. (2009). The maximization paradox: The costs of seeking alternatives. *Personality and Individual Differences*, 46, 631-635.

Diab, D. L., Gillespie, M. A., & Highhouse, S. (2008). Are maximizers really unhappy? The measurement of maximizing tendency. *Judgment and Decision making*, 3, 364-370.

Hanselmann, M., & Tanner, C. (2008). Taboos and conflicts in decision-making: Sacred values, decision difficulty, and emotions. *Judgment and Decision-making*, 3(1), 51-63.

van den Heuvel, C., Alison, L., & Crego, J. (2012). How uncertainty and accountability can derail strategic "save life" decisions in counter-terrorism simulations: A descriptive model of choice deferral and omission bias. *Journal of Behavioral Decision-making*, 25, 165-187.

- Iyengar, S. S., Wells, R. E., & Schwartz, B. (2006). Doing better but feeling worse: Looking for the “best” jobs undermines satisfaction. *Psychological Science*, *17*, 143–150.
- Kim, K., & Miller, E. G. (2017). Vulnerable maximizers: The role of decision difficulty. *Judgment and Decision Making*, *12*(5), 516–526.
- Klein, G. (1989). Strategies of decision-making. *Military Review*, 56–64 May 1989.
- Kokkoris, M. D. (2018). When the purpose lies within: Maximizers and satisfaction with autotelic choices. *Marketing Letters*, *29*, 73–85. <https://doi.org/10.1007/s11002-017-9443-4>.
- Kokkoris, M. D. (2019). Maximizing without borders: Evidence that maximizing transcends decision domains. *Frontiers in Psychology: Personality and Social Psychology*. <https://doi.org/10.3389/fpsyg.2018.02664>.
- Kruglanski, A. W. (1989). *Lay epistemics and human knowledge: Cognitive and motivational bases*. New York: Plenum Press.
- Kruglanski, A. W., Webster, D. M., & Klem, A. (1993). Motivated resistance and openness to persuasion in the presence or absence of prior information. *Journal of Personality and Social Psychology*, *65*(5), 861–876.
- Larsen, J. T., & McKibban, A. R. (2008). Is happiness having what you want, wanting what you have, or both? *Psychological Science*, *19*, 371–377.
- Lipshitz, R., Klein, G., Orasanu, J., & Salas, E. (2001). Taking stock of naturalistic decision making. *Journal of Behavioral Decision Making*, *14*(5), 331–352.
- McGrath, R. E., & Walters, G. D. (2012). Taxometric analysis as a general strategy for distinguishing categorical from dimensional latent structure. *Psychological Methods*, *17*(2), 284–293.
- Meehl, P. E. (1995). Bootstraps taxometrics: Solving the classification problem in psychopathology. *American Psychologist*, *50*, 266–275.
- Meehl, P. E., & Yonce, L. J. (1994). Taxometric analysis: I. Detecting taxonicity with two quantitative indicators using means above and below a sliding cut (MAMBAC procedure). *Psychological Reports*, *74*, 1059–1274.
- Meehl, P. E., & Yonce, L. J. (1996). Taxometric analysis: II. Detecting taxonicity using covariance of two quantitative indicators in successive intervals of a third indicator (MAXCOV procedure). *Psychological Reports*, *78*, 1091–1227.
- Misuraca, R., & Fasolo, B. (2018). Maximizing versus satisficing in the digital age: Disjoint scales and the case for “construct consensus”. *Personality and Individual Differences*, *121*, 152–160.
- Misuraca, R., Faraci, P., Gangemi, A., Carmeci, F. A., & Miceli, S. (2015). The Decision Making Tendency Inventory: A new measure to assess maximizing, satisficing, and minimizing. *Personality and Individual Differences*, *85*, 111–116.
- Moyano-Díaz, E., Cornejo, F., Carreño, M., & Muñoz, A. (2013). Bienestar subjetivo en maximizadores y satisficadores [subjective well-being in maximizers and satisficers]. *Terapia Psicológica*, *31*, 273–280.
- Nenkov, G. Y., Morrin, M., Ward, A., Schwartz, B., & Hurland, J. (2008). A short form of the Maximization Scale: Factor structure, reliability and validity studies. *Judgment and Decision making*, *3*, 371–388.
- Osiurak, F., Faure, J., Rabeyron, T., Morange, D., Dumet, N., Tapiero, I., ... Finkel, A. (2015). Déterminants de la procrastination académique: Motivation autodéterminée, estime de soi et degré de maximisation [predictors of academic procrastination: Self-determined motivation, self-esteem, and degree of maximization]. *Pratiques Psychologiques*, *21*, 19–33.
- Parker, A. M., Bruine de Bruin, W., & Fischhoff, B. (2007). Maximizers versus satisficers: Decision-making styles, competence, and outcomes. *Judgment and Decision making*, *2*, 342–350.
- Pascual, R., & Henderson, S. (1997). Evidence of naturalistic decision-making in military command and control. In G. K. Caroline, & E. Zsombok (Eds.). *Naturalistic decision-making* (pp. 217–226). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Polman, E. (2010). Why are maximizers less happy than satisficers? Because they maximize positive and negative outcomes. *Journal of Behavioral Decision Making*, *23*, 179–190.
- Power, N., & Alison, L. (2017). Redundant deliberation about negative consequences: Decision inertia in emergency responders. *Psychology, Public Policy, and Law*, *23*(2), 243–258.
- Power, N., & Alison, L. J. (2018). Decision inertia in critical incidents. *European Psychologist*, *24*, 209–218.
- Purvis, A., Howell, R. T., & Iyer, R. (2011). Exploring the role of personality in the relationship between maximization and well-being. *Personality and Individual Differences*, *50*, 370–375.
- Schwartz, B. (2004). *The paradox of choice: Why more is less*. New York: Harper Perennial.
- Schwartz, B., Ward, A., Monterosso, J., Lyubomirsky, S., White, K., & Lehman, D. R. (2002). Maximizing versus satisficing: Happiness is a matter of choice. *Journal of Personality and Social Psychology*, *83*, 1178–1197.
- Scott, S. G., & Bruce, R. A. (1995). Decision-making style: The development and assessment of a new measure. *Educational and Psychological Measurement*, *55*(5), 818–831.
- Seuntjens, T. G., Zeelenberg, M., van de Ven, N., & Breugelmans, S. M. (2015). Dispositional greed. *Journal of Personality and Social Psychology*, *108*, 917–933.
- Shortland, N. D., & Alison, L. J. (2019). Colliding sacred values: A psychological theory of least-worst option selection. *Thinking and Reasoning*. <https://doi.org/10.1080/13546783.2019.1589572>.
- Shortland, N. D., Alison, L. J., & Moran, J. (2019). *Conflict: How soldiers make impossible decisions*. Oxford, UK: Oxford University Press.
- Spunt, R. P., Rassin, E., & Epstein, L. M. (2009). Aversive and avoidant indecisiveness: Roles for regret proneness, maximization, and BIS/BAS sensitivities. *Personality and Individual Differences*, *47*, 256–261.
- Turner, B. M., Rim, H. B., Betz, N. E., & Nygren, T. E. (2012). The maximization inventory. *Judgment and Decision-making*, *7*(1), 48–60.
- van den Heuvel, C., Alison, L., & Power, N. (2014). Coping with uncertainty: police strategies for resilient decision-making and action implementation. *Cognition, Technology & Work*, *16*(1), 25–45.
- Waller, N. G., & Meehl, P. E. (1998). *Multivariate taxometric procedures: Distinguishing types from continua*. Newbury Park, CA: Sage.
- Wang, S. B., & Ruscio, J. (2017). *RTaxometrics: An R package for taxometric analysis*. (Manuscript submitted for publication).
- Weaver, K., Daniloski, K., Schwarz, N., & Cottone, K. (2015). The role of social comparison for maximizers and satisficers: Wanting the best or wanting to be the best? *Journal of Consumer Psychology*, *25*, 372–388. <https://doi.org/10.1016/j.jcps.2014.10.003>.
- Wilkinson, B., Cohen-Hatton, S. R., & Honey, R. C. (2019). Decision-making in multi-agency groups at simulated major incident emergencies: In situ analysis of adherence to UK doctrine. *Journal of Contingencies and Crisis Management*, *27*(4), 306–316.