Poster
TITLE
Understanding Cognitive Complexity: The Impact of Need for Closure and Task Type

SHORTENED TITLE
Understanding Cognitive Complexity

ABSTRACT
Organizational challenges have increased in complexity calling for efforts to support the capacity to integrate diverse perspectives. Recognizing and integrating diverse views is known as cognitive complexity. We present two studies that explore the relationship between cognitive complexity and three conceptually related cognitive characteristics (study 1) and the impact of cognitive complexity on task performance (study 2). Results show, of three cognitive characteristics, need for cognitive closure is relatively most important in predicting cognitive complexity. Our results also clarify the influence of cognitive complexity on task performance by specifying the impact of task type.

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Introduction

The challenges faced by organizations have increased in complexity calling for increased value of multi-dimensional thinking. Employees are also often called on to solve complex problems in a dynamic environment and asked to work collaboratively with others who hold different perspectives and have diverse backgrounds. It is therefore imperative that organizations prioritize efforts to support the capacity of employees to be tolerant of diverse views and integrate perspectives as necessary to address complex issues.

The tendency to recognize the varying dimensions of a situation and then integrate these dimensions is known as cognitive complexity (Bieri, 1955; Streufert & Castore, 1971). As researchers seek to understand individual information processing and decision-making processes, research on cognitive complexity has provided unique insights into cognitive structures and resulting behaviors. While the popularity of cognitive complexity has remained relatively consistent, definitional and methodology confusion had caused interest in the construct to wane until a recent resurgence of interest (Woznyj et al., 2017) has led to attempts to clarify its measurement (Kovara and Filip, 2015; Suedfeld & Tetlock, 2014), definition (Conway et al., 2014), and nomological network (Woznyj et al., 2017).

This research presents two studies that hope to contribute to this resurgence by exploring, clarifying, and specifying the relationship between cognitive complexity and three conceptually related cognitive characteristics (study 1) and cognitive complexity's relationship with task performance (study 2). These studies contribute to our understanding of the individual differences related to cognitive complexity and how cognitive complexity may contribute to organizational outcomes.

Cognitive Complexity

Cognitive complexity, as a process, is conceptualized as a flexible and adaptive characteristic of information processing, comprised of two components: differentiation and integration (Schroder et al., 1967). Differentiation represents the identification of distinct elements and dimensions that can be analyzed in an event and integration refers to the ability to make connections and explore relationships among the identified elements (Curşeu & Rus, 2005). Information that is processed in a cognitively complex way will represent multiple perspectives (i.e., differentiation) as well as similarities, patterns, and trade-offs between the perspectives (i.e., integration).

Past research has shown that the more individual elements identified in a problem and integrated into the solution, the more novel and nuanced the solution will be (Curşeu & Rus, 2005). Hence, cognitive complexity has been associated with higher performance in many cognitive behaviors. When individuals process information in a highly cognitively complex manner, they search for and use more information to make decisions (Choi, 2010) when compared to individuals using less cognitively complex processing. This may explain why higher cognitive complexity is associated with more effective information processing, including improved performance in decision making (Gruenfeld, 1995), problem-solving (Bartunek, Gordon, & Weathersby, 1983), and strategic planning (Streufert & Swezey, 1986).

Cognitive Antecedents

In study 1, we explore the relative importance of three cognitively-based characteristics that are empirically or conceptually related to cognitive complexity. In the section following, we provide a brief overview of each characteristic.

Paradox mindset. According to paradox theory, contradictions are inherent within organizations but can be leveraged to enhance organizational performance (Smith & Lewis, 2011). Paradox mindset, a construct informed from the recognition that individuals experience contradictory tensions, refers to an individual's ability to shift "expectations from rationality and linearity to accept paradoxes as persistent and unsolvable puzzles" (Smith & Lewis, 2011; p. 385). Those with a paradox mindset are less vulnerable to the discomfort created by conflicting tensions at work and will, instead, identify strategies to manage tensions such as being flexible in identifying opportunities to learn from these tensions (Miron-Spektor & Beenen, 2015).

Tolerance for ambiguity represents the manner in which individuals perceive and process information in situations marked by uncertainty. Those with a high tolerance for ambiguity experience less stress, are less likely to react prematurely, and embrace ambiguous situations (Furnham, 1994). Meta-analytic evidence supports a relationship between tolerance for ambiguity and cognitive complexity (Wozny et al., 2017).

Need for cognitive closure, a motivational tendency, refers to "to persons' motivation with respect to information processing and judgment" (Webster & Kruglanski, 1994, p. 1049). Those with a high need for cognitive closure derive a sense of urgency (i.e., an inclination to seize information) and permanence (i.e., an inclination to freeze information; Webster & Kruglanski, 1997). Based on preliminary evidence (Brown et al., 2020), we expected need for cognitive closure to be relatively more important than tolerance for ambiguity and paradox mindset.

Hypothesis 1: Need for cognitive closure will be relatively more important than paradox mindset and need for cognitive closure, in predicting cognitive complexity.

Method

Study 1 - Sample. Study 1 included 287 participants after listwise deletion of participants with missing data. The sample had a mean age of 33.93 (SD = 9.65). Of the total sample, 52.3% of the participants reported being female and 73.9% reported being Caucasian/White.

Study 1 – Measures.

Paradox mindset. To measure paradox mindset, we used a 9-item measure developed by (Miron-Spektor et al., 2017). Sample items includes "Tension between ideas energize me". The measure demonstrated sufficient internal consistency (alpha = .86).

Tolerance for ambiguity was measured using an 8-item measure developed by (Dalbert, 1999). Sample items includes "When I work or study, I like things to be predictable and routine". The measure demonstrated sufficient internal consistency (alpha = .79).

Need for cognitive closure. To measure need for cognitive closure, we used a 14-item measure developed by, (Roets & Van Hiel, 2011). Sample items includes "In case of uncertainty, I prefer to make an immediate decision, whatever it may be". The measure demonstrated sufficient internal consistency (alpha = .81).

Cognitive complexity. Cognitive complexity was measured using the Role Construct Grid (Brier, 1955) and calculated using R syntax provided by Woznyj et al. (2019).

Study 1 Procedures. Survey questions were hosted on Qualtrics. After viewing the consent form, participants who agreed to take part in the study were directed to the survey hosted on Qualtrics via Prolific. First, participants completed surveys measuring the predictors. Participants then completed the cognitive complexity measure, followed by the demographic measure.

Study 1 Results

Study descriptives and correlations can be found in Table 1. We conducted a relative weight analysis using RWA Web (Tonidandel & LeBreton, 2015). An examination of the relative weights indicated that need for cognitive closure (87%) explained relatively more variance in cognitive complexity, compared to tolerance for ambiguity (11%) and paradox mindset (2%). Consequently, we made the decision to pursue our empirical examination of cognitive complexity by including need for cognitive closure, and excluding tolerance for ambiguity and paradox mindset in study 2. Having some clarity about the cognitive characteristics that predict cognitive complexity is useful. However, more can be gained by understanding the impact of cognitive complexity on task performance.

In study 2, we sought to explore how cognitive complexity relates to performance on a divergent versus a convergent thinking task in order to better understand the conditions under which cognitive complexity is helpful for task performance. We were also interested in exploring the intervening role of need for cognitive closure on the relationship between cognitive complexity and task performance. Before describing those predictions, we begin with our hypotheses about need for cognitive closure.

Need for Cognitive Closure and Cognitive Complexity

Because individuals with a high need for closure have a sense of urgency and permanence (Webster & Kruglanski, 1997) they might be less inclined to dedicate the time and cognitive resources necessary to process information in a manner that is cognitive complex.

Hypothesis 2: Need for cognitive closure will be positively related to cognitive complexity.

Cognitive Complexity and Task Performance

Research on cognitive complexity and performance has been mixed. Some research has supported that cognitive complexity is positively related to decision making (Gruenfeld, 1995), problem solving (Bartunek et al., 1983), and strategic planning (Streufert & Swezey, 1986). However, in a recent meta-analysis on cognitive complexity (Woznyj et al., 2019), this construct was not found to have a significant relationship with individual task performance. The authors, in alignment with some past research, posited that the relationship between cognitive complexity and task performance is dependent on task type.

Convergent Tasks

Convergent tasks are aimed at resolving ambiguity to determine the best solution to a problem (Cropley, 2006). Convergent thinking tasks typically involve integrating various elements to generate one "correct" solution. There are many examples of tasks that require convergent thinking in organizations, such as strengthening cohesion and promoting innovation within a team (Myszkowski et al., 2015).

Divergent Tasks

Divergent tasks involve producing multiple diverse solutions to a problem. Divergent thinking tasks typically involve generating as many solutions as possible, rather than generating a single, "correct" response (Wronska et al., 2018). Tasks that involve divergent thinking in organizations include brainstorming ways to motivate employees and promoting the adoption of new software to employees (Myszkowski et al., 2015).

Convergent/divergent tasks and need for cognitive closure.

Convergent tasks often require a single correct solution while divergent tasks involve generating multiple solutions. As such, it is expected that individuals with a high need for closure have a higher person-task fit with convergent tasks than divergent tasks (Wronska et al., 2019). We, therefore, propose that high need for closure will be positively associated with convergent task performance but negatively associated with divergent task performance.

Hypothesis 3: Need for cognitive closure will be positively related to convergent task performance.

Hypothesis 4: Need for cognitive closure will be negatively related to divergent task performance.

Convergent/Divergent Tasks and Cognitive Complexity

Because cognitive complexity involves perceiving the multi-faceted nature of information, a high degree differentiation, more time for information processing, and greater volume of information (Bieri, 1955; Hooijberg et al.,. 1997), we propose that cognitive complexity will be a stronger predictor of performance on divergent task than convergent tasks. Our logic being that a greater volume and diversity of information, as well as increased time, will be of more benefit when working to identify multiple diverse solutions.

Hypothesis 5: Cognitive complexity will be a stronger predictor of task performance on the divergent task than on the convergent task.

Hypothesis 6: Need for cognitive closure moderates the two-way interaction effect between cognitive complexity and divergent task performance such that the negative relationship between cognitive complexity and performance is stronger when need for closure is low compared to high.

Study 2 – Sample. Study 2 included 299 participants after listwise deletion of participants with missing data. 151 participants were in the convergent thinking task condition and 148 participants were in the divergent thinking condition. The sample had a mean age of 34.47 (SD = 10.17). Of the total sample, 50.5% of the participants reported being female and 70.2% reported being Caucasian/White.

Study 2 – Measures

Need for cognitive closure. To measure need for cognitive closure, we used the same scale as in Study 1. The measure demonstrated sufficient internal consistency (alpha = .81).

Cognitive complexity. Cognitive complexity was measured using the Role Construct Grid (Brier, 1955) and calculated using R syntax provided by Woznyj et al., (2019). Higher scores indicate *lower* cognitive complexity.

Procedures

For the divergent (alternate uses) task, participants were given a list of five items; car tire, glass bottle, cardboard, a knife, and a tin can, and were instructed to come up with as many different, unusual, and creative uses for each item as they were able to think of. The uses for items participants came up with had to be practical and achievable. The uses also had to be genuine (a non-genuine response might be to recycle or throw away the item), and they also could not be the intended use of the item (such as using the knife to cut fruit). The participants were able to input up to ten different uses into text boxes in the survey and were given 90 seconds per item to list their ideas. After listing as many different creative uses as possible, participants were instructed to select the most creative use that they came up with.

To code the responses of the participants, the two types of coding conducted are creativity coding and fluency coding. For creativity coding, responses were ranked from zero to two based on the creativity of responses from the participants. Participant responses were given a zero if they suggested the intended use of the object or if the idea was impractical, a one if they suggested a creative usage of the item in its current form, and a two if they suggested a creative usage of the item that can change the item's form. For fluency coding, the number that was coded is associated with the number of unique ideas that the participant suggested. Participant responses that were similar and had the same idea are only counted as one idea because only unique ideas are coded.

Convergent thinking task performance was evaluated using a compound remote associates task, which has been used previously to evaluate convergent thinking and problem solving performance (Zedelius et al., 2020). In each trial, participants were shown three words (e.g., “thread, pine, pain”) and were asked to write a fourth word that could be used to connect the three words presented (e.g., “needle” as in “needle and thread”, “pine needle”, “needles are painful”). All words and solutions were taken from Zedelius and Schooler (2015). Each participant was presented 27 trials in addition to one example trial which was not evaluated. Participants had 40 seconds to record their responses and received one point for each correct solution, for a total of 27 possible points.

Study 2 Results

Study descriptives and correlations can be found in Table 2.

NFC was significantly related to cognitive complexity in study 2, (beta = .12, $p < .05$), such that high need for closure predicted lower cognitive complexity scores, supporting hypothesis 2.

NFC was significantly related to both convergent (beta = -.27, $p < .001$) and divergent task performance (beta = -.33, $p < .001$) such that higher need for closure was related to lower performance on both divergent and convergent thinking tasks. These findings do not support hypothesis 3 but support hypothesis 4.

Contrary to our hypothesis, cognitive complexity was not related to divergent thinking task performance (beta = -.04, $p = .65$). However, cognitive complexity was negatively related to convergent thinking task performance, such that higher cognitive complexity scores (which indicate low cognitive complexity) predicted lower performance on the convergent task (beta = -.28, $p < .001$). In other words, high cognitive complexity predicted high performance on the convergent task. Therefore, hypothesis 5 was not supported. Finally, we did not find a significant interaction between cognitive complexity, task type, and need for closure, thus not supporting hypothesis 6.

Discussion

Overall, our study makes two important contributions. First, we demonstrated that, of three conceptually related cognitive individual differences, need for cognitive closure is relatively most important in predicting cognitive complexity. This insight adds clarity to the literature about predictors of cognitive complexity—insight that can enhance theory building and practical implications. Second, our study also clarifies the influence of need for cognitive closure and cognitive complexity on task performance by exploring the contextual impact of task type. Importantly, we advance the literature by demonstrating that cognitive complexity, in fact, has an impact on convergent task performance. In sum, our results add to the growing evidence about predictors and outcomes related to cognitive complexity.

Extant meta-analytic evidence related to predictive psychological variables indicate that cognitive ability, tolerance for ambiguity, need for achievement, and three of the Big Five (i.e., openness, conscientiousness, and agreeableness) have small to moderate effects on cognitive complexity (Woznyj et al., 2020). Our findings add need for cognitive closure to the nomological network surrounding cognitive complexity and highlight the importance of considering the impact of motivated social cognition in the prediction of cognitive complexity, given the origin of need for cognitive closure to social cognitive theory (Webster & Kruglanski, 1994). This implies the need for future research to explore the impact of need for cognitive closure and potential moderating sources in an interpersonal and team-based setting where cognitive complexity is deemed critical to task success. Relatedly, our results call for future research to examine the impact of cognitive complexity based on contextual factors including task type.

Prior to our findings, it was noted that "cognitive complexity offers little in terms of predictive potential of typical key outcomes" (Woznyj et al., 2020, p. 16). Yet, when examining the impact of cognitive complexity by task type, our findings question previous null effects by suggesting that high cognitive complexity is helpful when performing convergent tasks. Consequently, it appears that the identification of distinct informational elements and dimensions and the integration among these elements and dimensions supports the resolution of ambiguity to determine the best solution (i.e., convergent task performance) but not the generation of multiple diverse solutions (i.e., divergent task performance). Future empirical research is needed to replicate these findings and advance theory explaining the role of cognitive complexity during convergent tasks.

Conclusion

Our research demonstrates that those high in need for cognitive closure, a socially motivated cognitive individual difference, could bring less cognitive complexity to activities requiring high cognitive complexity. These activities may involve complex decision-making and problem-solving tasks or tasks requiring multidimensional thinking. Further, high cognitive complexity could be beneficial to tasks involving convergent thinking. In summary, these findings help to clarify our understanding of what influences cognitive complexity and when cognitive complexity impacts performance.

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Table 1. *Intercorrelations of Study Variables, Study 1*

	M	SD	1	2	3	4
1. Cognitive Complexity (CC)	82.19	25.62	-	-	-	-
2. Need for Closure (NFC)	51.39	11.04	.13*	(.81)	-	-
3. Tolerance for Ambiguity	29.71	6.67	.04	-.13*	(.79)	-
4. Paradox Mindset	29.84	6.18	.01	-.22**	.50**	(.86)

Table 2. *Intercorrelations of Study Variables, Study 2*

	M	SD	1	2
1. Cognitive Complexity (CC)	82.19	24.9	-	-
2. Need for Closure (NFC)	52.03	11.05	0.12*	-
3. Divergent Performance	13.33	5.22	-0 .04	-0.33**
4. Convergent Performance	24.29	7.08	-0.28**	-0.27**

Note: Participants either participated in the divergent or convergent condition, so there is no correlation coefficient for the relationship between these variables. Higher scores on the CC variable indicate lower CC, therefore negative relationships between CC and performance indicate a positive relationship between CC (the construct) and performance.

Criterion = Cognitive Complexity (R^2 = .02)

Predictor	*b*	RW	CI-L	CI-U	RS-RW
Intercept					
Need for Cognitive Closure		0.02	-0.01	0.07	86.99%
Tolerance for Ambiguity		0.00	-0.02	0.01	10.76%
Paradox Mindset		0.00	-0.03	0.01	2.25%

Note: = RW = raw relative weight (raw weights will sum to R^2, within rounding error); CI-L = lower bound of confidence interval used to test the statistical significance of raw weight; CI-U = upper bound of confidence interval used to test the statistical significance of raw weight; RS-RW = relative weight rescaled as a percentage of predicted variance in the criterion variable attributed to each predictor (within rounding error rescaled weights sum to 100%)

Table 4. *Summary of Results, Study 2*