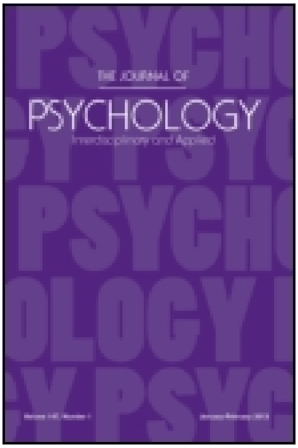

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Individual Ambidexterity: Exploring and Exploiting in Dynamic Contexts

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Individual Ambidexterity: Exploring and Exploiting in Dynamic Contexts

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ABSTRACT. Previous research regarding the role of individuals within the organizational ambidexterity construct has primarily focused on behavioral characteristics of managers. Drawing from the organizational, psychological, and neuroscience literatures, this study develops and tests hypotheses concerning the formative construct of *Individual Ambidexterity (IA)*, the cognitive abilities necessary to balance efforts of exploration and exploitation. In an initial criterion-related predictive validity laboratory study, 181 undergraduate students completed successive trials in a computer-simulated, real-time dynamic microworld context. Findings explained unique variance beyond measures of general intelligence on the total score of task adaptive performance. The results indicate a novel combination of abilities that may further understanding of how individual abilities contribute to the ambidexterity literature.

Keywords: ambidexterity, computer-simulated microworlds, dynamic decision-making, exploration vs. exploitation

ORGANIZATIONS NEED TO EXPLORE OPPORTUNITIES and exploit that which is already known (March, 1991) to meet the demands of an increasingly dynamic environment. The inherent tension that exists in the two seemingly opposing modes presents a challenge in doing both well. Ambidexterity is the term used to describe the active management of these poles. While most ambidexterity research focuses at the organizational level, it remains a multilevel phenomenon also driven upward by individuals as they contend with a dynamic context. This study aims to make several contributions to the ambidexterity literature. First, it responds to a paucity of empirical data on individual ambidexterity. Next it does so with implicit—objective measures of individual ability rather than self-reports. Last, it seeks to measure simultaneous or rapidly sequential ambidexterity in a

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context that functionally represents the kinds of real time dynamic environments that today's organizational actors must manage.

While few in number, empirical studies suggest that individuals are a significant source of organizational ambidexterity (Gibson & Birkinshaw, 2004; Lubatkin, Simsek, Ling, & Veiga, 2006; Mom, van den Bosch, & Volberda, 2007, 2009). These studies emphasize the behavioral actions undertaken by managers to explore new information and to exploit existing knowledge. For example, research by Mom and colleagues (2007, 2009), sought to understand the extent to which individual managers balance behaviors of exploration and exploitation. While these two studies represent the primary empirical examples at the individual level of analysis, they do not shed light on the individual differences of those who are managing the dilemma. As such, Felin, Zenger, and Tomsik (2009) suggest taking a "human capital heterogeneity" perspective, focusing on what individual differences and abilities may collectively contribute to organizational outcomes (pg. 566). Regarding abilities, there is a need to measure "exploration and exploitation at the managerial level of analysis using objective measures" (Mom et al., 2007, p. 927). In sum, research has yet to explore what abilities may contribute to individual ambidexterity.

One reason individual difference in ambidexterity research is sparse may be due to an existing bias on structure instead of context. A focus on *structural* ambidexterity at the individual level of analysis differentiates individuals by job function within business units. For example, individuals responsible for generating R&D may focus on exploration while individuals responsible for accounting may emphasize exploiting efficiencies and economies of scale. In contrast, *contextual* ambidexterity highlights cultures in which individuals are encouraged and supported to simultaneously balance exploration and exploitation as necessary (Gibson & Birkinshaw, 2004). Structure dilutes individual differences and avoids the reality, that regardless of job function, individual actors work within increasingly dynamic contexts that require ambidextrous behaviors.

The more dynamic and unpredictable the context, the more individual ambidexterity is thought to be necessary for success (Davis, Eisenhardt, & Bingham, 2009). Yet there remains a gap in the ambidexterity literature as it pertains to dynamic environments (Gibson & Birkinshaw, 2004). This may be due to the difficulty of capturing individual data in a dynamic context. Individual level studies fail to capture the *simultaneity* of exploring and exploiting, asking about past behavior of exploring or exploiting, rather than testing one's ability to cycle between them. This further assumes, perhaps implicitly, that one explores or exploits between tasks rather than *within* them, creating a deeper emphasis on temporally sequential versus simultaneous ambidexterity (Raisch, Birkinshaw, Probst, & Tushman, 2009). This is to say that in a dynamic context individuals can neatly compartmentalize whether to explore or exploit. This is unlikely to be the case, as individuals attempt to manage task related dynamism through simultaneous ambidextrous behavior (He & Wong, 2004). As rates of change and uncertainty continue to rise, so do the instances where individuals face dynamic decision making (DDM) scenarios (Farhoomand & Drury, 2002; Kozlowski et al., 2001). DDM scenarios are representative of the ambiguous, complex environments yielding contradictory information and thus compounding managerial decision-making (McKenzie, Woolf, van Winkelen, & Morgan 2009). Recently Smith and colleagues (2010) noted that DDM scenarios represent the contexts in which simultaneous ambidexterity are required by individuals in organizations (Smith, Binns, & Tushman, 2010).

Individual Ambidexterity in Dynamic Contexts

This study takes a decidedly cognitive perspective of individual ambidexterity. This is in part warranted as the tradeoff between exploration and exploitation at the individual level is described as part of a competing *cognitive* agenda (Eisenhardt, Furr, & Bingham, 2010; Gilbert, 2006, Smith & Tushman, 2005). Still others note that the most successful managers are able to achieve ambidexterity by doing both simultaneously (Gibson & Birkinshaw, 2004; He & Wong, 2004; Mom et al., 2007). Whether it is actually simultaneous or rapidly sequential (Adler, Goldoftas, & Levine, 1999), individuals need to be able to flexibly cycle between the differing modes within environments that are changing.

Dynamic contexts further challenge the cognitive capacity of individuals to explore and exploit (Smith & Tushman, 2005). These contexts include the interaction of dynamism, complexity and time-constraints (Brehmer, 1992) that often require individuals to manage exploration and exploitation (Smith et al., 2010). In order to capture the elements found throughout the dynamic experiences individuals encounter often within organizational life, organizational scholars have employed computer-simulated microworlds to investigate highly complex phenomena in a dynamic context (Beersma, Hollenbeck, Humphrey, Moon, Conlon, & Ilgen, 2003; Johnson et al., 2006; LePine, Colquitt, & Erez, 2000). Therefore, a DDM-based microworld offers the necessary controlled context to properly test the impact of managing the tradeoff between exploration and exploitation on task adaptive performance.

There exists a need for balance between the two modes, yet there is little evidence to suggest what supports being able to do it well (Eisenhardt et al., 2010). This is a key limitation delineated in organizational (Mom et al., 2009; Raisch et al., 2009), psychological (Laureiro-Martinez, Brusoni, & Zollo, 2010), and neuroscience literatures (Aston-Jones & Cohen, 2005). In order to address this limitation, we propose *Individual Ambidexterity* (IA*)*, as the individual-level cognitive ability to flexibly adapt within a dynamic context by appropriately shifting between exploration and exploitation. IA is a formative construct made up of three variables necessary for managing the exploration/exploitation dilemma. IA includes the variables of divergent thinking, focused attention and cognitive flexibility. The following section will explore the variables that account for the formation of the *Individual Ambidexterity (IA)* construct and propose testable hypotheses.

Intelligence and Dynamic Contexts

Any discussion of testing an individual-level ambidexterity construct needs to build upon the foundation of general intelligence. In dynamic contexts, intelligence is the most well-studied and consistently predictive variable. While not part of the ambidexterity construct, intelligence needs to be included in the exploration of individual abilities. Intelligence describes the ability to assess the needs of the context and adapt accordingly (Sternberg, 1999). Others relate intelligent thought to one's ability to choose the most effective strategies in novel scenarios (Frensch & Sternberg, 1989). Both interpretations are supported as greater general intelligence is related to performance in novel tasks (Hartigan & Widgor, 1989; Hunter & Hunter, 1984). Also, the relationship between intelligence and performance becomes stronger as task complexity increases (Ackerman, 1988). Higher intelligence is also linked to the ability to modify attentional processes (Schafer, 1979). Multiple forms of intelligence have demonstrated a predictive capacity in DDM related adaptive outcomes (Gonzalez, Vanyukov, & Martin, 2005; LePine et al., 2000).

Given this rationale, we offer the following:

Hypothesis 1: Intelligence will explain significant variance in task adaptive performance.

Individual Exploration

Exploration is about searching for novelty in the organizational context (Levinthal & March, 1993) and "experimentation with new alternatives" (March 1991, p. 81). This is also the case with the psycho-physiological aspects of individual exploration, as neuroscientists associate exploration with the rates of neuronal firing in the Locus Coeruleus (LC) area of the brain. Two alternate modes, termed phasic and tonic, resulted in alternate forms of attentional response activity. The tonic mode in the LC suggests searching for alternative ways of approaching a task (Aston-Jones & Cohen, 2005). Individuals who explore effectively are able to stretch toward new ideas and concepts (Katila & Ahuja, 2002; Levinthal & March, 1993; Sidhu, Volberda, & Commandeur, 2004). Given this conceptualization, individual exploration shares a natural alignment with the cognitive aspects of creativity (Amabile, 1996).

Divergent thinking is a suitable parallel to the cognitive aspects of exploration. It is often linked to the cognitive aspects of creativity (Baer, 1993) and is defined as an ability to generate as many responses as possible to a stimulus (Guilford, 1950). It is related to a broad scanning ability that is separate from general intelligence (Mendelsohn, 1976). In a dynamic environment this ability for explorative inclusion is particularly important (Weick & Sutcliffe, 2006). Table 1 provides

TABLE 1. Conceptual Similarities Between Exploration Construct and Divergent Thinking, Exploitation Construct and Focused Attention, and Ambidexterity Construct and Cognitive Flexibility

Ambidexterity Study	*Definition of Exploration*
Aston-Jones & Cohen, 2005	"Seek new behaviors by continuing to sample the environment in search of novel and potentially more valuable opportunities than those already discovered" (p. 420).
Cohen, McClure, & Yu (2007)	"Explore risky but potentially more profitable [alternatives]" (p. 933).
Hills, Todd, & Goldstein (2010)	"The ability to detect the resource contingencies available in different environments" (p. 591).
Laureiro-Martinez, Brusoni, & Zollo (2010)	"Behavior that includes search for alternatives and disengagement from the current task" (p. 97).
Mom, Van Den Bosch, & Volberda (2009)	"Searching for new possibilities, evaluating diverse options, adaptability, new skills" (p. 820).
Ambidexterity Study	*Definition of Exploitation*
Aston-Jones & Cohen (2005)	"Engaged in behaviors associated with the most valuable [states] that it has already discovered" (p. 420).
March (1991)	"Refinement, choice, production, efficiency, selection, implementation, and execution" (p. 71). "Its returns are positive, proximate, and predictable" (p. 85).
Mom, Van Den Bosch, & Volberda (2009)	"A lot of experience, routine, short-term goals, present knowledge" (p. 820).
Smith & Tushman (2005)	"Rooted in variance-decreasing activities and discipline problem-solving" (p. 522).
Ambidexterity Study	*Definition of Ambidexterity*
Gupta, Smith, & Shalley (2006)	"The synchronous pursuit of both exploration and exploitation" (p. 693).
Hills, Todd, & Goldstein (2010)	"The ability to switch flexibly" (p. 593).
Laureiro-Martinez, Brusoni, & Zollo (2010)	"Cognitive flexibility to recognize the advantages and disadvantages of the two alternative allocations (exploration and exploitation)" (p. 98).
Lavie, Stettner, & Tushman (2010)	"Ambidexterity resolves the tension between exploration and exploitation by suggesting these activities are maintained simultaneously" (p. 129).
McClure, Gilzenrat, & Cohen (2005)	"Determining how to adaptively move between exploitative and exploratory behaviors in changing environments" (p. 1).

Note. A large set of references for each construct can be obtained from the authors.

conceptual similarities between exploration and divergent thinking as well as the other variables used in this study.

Given this rationale, we offer the following:

> *Hypothesis 2*: Individual exploration, as measured by divergent thinking, will explain significant variance in task adaptive performance beyond that explained by intelligence.

Individual Exploitation

Exploitative activity helps to create reliability in experience (Levinthal & March, 1993). Individual exploitation provides certainty by focusing attention on what is already known rather than scanning for new information (Holmqvist, 2004). In order to exploit, an individual needs to narrow attention and focus on the existing parameters of the task at hand (Nelson & Winter, 1982). In this sense, a likely parallel to exploitation at the individual level is the ability to focus attention (Aston-Jones & Cohen, 2005; Laureiro-Martinez et al., 2010), as indicated by the phasic mode of the Locus Coeruleus. Table 1 provides conceptual similarities between exploitation and focused attention.

Focused attention is about attending to present relevant stimuli while ignoring new and potentially disruptive information (Lustig, May, & Hasher, 2001). It acts as a filter to keep out information (Kahneman & Treisman, 1984) allowing for focus on relevant stimuli, while opposing distraction (Van Zomeren & Brouwer, 1994). In dynamic situations, one must be able to manage the effects of incoming information within the current course of cognitive action (Anderson, 1983).

Accordingly, we offer Hypothesis 3:

> *Hypothesis 3*: Individual exploitation, as measured by focused attention, will explain significant variance in task adaptive performance beyond that explained by intelligence.

Cognitive Flexibility

It is a challenge for individuals to be able to succeed at both exploration and exploitation (Gupta, Smith, & Shalley, 2006). Individuals who behave ambidextrously likely attempt to do both in a simultaneous fashion (e.g. Gibson & Birkinshaw, 2004; He & Wong, 2004; Tushman & O'Reilly, 1996). Yet it is more likely that a rapid sequence of set shifting between exploration and exploitation takes place in real time (Hodgkinson & Sparrow, 2002; Laureiro-Martinez et al., 2010; Stemme, Deco, & Busch, 2007). Ambidextrous individuals use flexibility to manage exploration and exploitation (Mom et al., 2007). Table 1 provides conceptual similarities between ambidexterity and cognitive flexibility.

This study looks at individual cognitive flexibility as the mechanism that enables ambidextrous behavior within a real time task. Cognitive flexibility is an executive function that supports successful adjustment through its underlying components of cognitive control and set shifting (Clark, 1996). Cognitive control helps individuals in overcoming automatic response sets (Diekman, 1982), in favor of a more appropriate contextual response (Reder & Schunn, 1999). *Cognitive flexibility,* the ability to cognitively control and shift mental set (Cañas, Quesada, Antolí, & Fajardo, 2003), supports appropriate toggling between exploration and exploitation. As contexts become more dynamic the need for cognitive flexibility grows, in order to balance being both explorative and exploitative (Davis et al., 2009).

Hypothesis 4: Cognitive flexibility will explain significant variance in task adaptive performance beyond that explained by intelligence.

Formative Construct of Individual Ambidexterity (IA)

IA represents an integrative ability to flexibly explore and exploit. While organizational structures may support ambidexterity (Gibson & Birkinshaw, 2004), there is an emerging belief that ambidexterity requires in part, individuals who are able to combine exploration and exploitation (Raisch et al., 2009; Smith & Tushman, 2005). *IA* within a real time dynamic environment denotes an ongoing balance between responding to varying flows of information. Exploration thus supports one in noticing alternatives (Aston-Jones & Cohen, 2005), and being more likely to consider parts of the environment that others may miss (Chan & Schmitt, 2000). On the other hand, noticing too much information can disrupt the focus of attention (Schneider, Dumais, & Shiffrin, 1984), jeopardizing the current cognitive thread of the given task (Kuhl & Kazen-Saad, 1988). Having the capacity to be ambidextrous, by flexibly utilizing exploration and exploitation may help determine successful adaptation within a given task (Necka, 1999). In other words, a combination of cognitive flexibility, exploration and exploitation are necessary to form ambidexterity.

Accordingly, we propose Hypothesis 5:

Hypothesis 5: The formative construct of *Individual Ambidexterity (IA)* will explain significant variance in task adaptive performance beyond that explained by intelligence.

In sum, research on individual-level ambidexterity has focused on the actions taken by managers to balance behaviors of exploration and exploitation. Despite the importance placed on ambidexterity in the extant literature, no studies have investigated the individual differences regarding abilities to manage the dilemma between exploration and exploitation. To address this gap in the ambidexterity literature the present study aims test the formative construct of individual ambidexterity employing implicit—objective measures of individual ability in a real-time, dynamic context.

Method

Participants

Participants were undergraduate business majors (n = 181; 101 men and 80 women; ranging from 18–25 years old with a mean age of 21 years). Data was collected during a single testing period lasting approximately 45 minutes per participant. Participants signed up for a convenient testing period at a computer lab. A test proctor was present during all sessions to help ensure that external conditions in the lab remained consistent for all participants. IRB requirements were followed to protect the rights of participants to include a signed consent form, a clearly stated purpose of the study and a carefully secured data collection process.

Instruments

The Networked Fire Chief (NFC): Measuring Task Adaptive Performance. The NFC program was used as a way to create task demands that change dynamically (Omodei & Wearing, 1995), while controlling the experience across participants (LePine et al., 2000). The NFC is a simulated dynamic decision making (DDM) environment, which presents ongoing change under a time pressured situation.

The NFC program puts the participant in the role of a "fire chief" tasked with extinguishing simulated forest fires. The goal is to "put out" fires as quickly as possible using water carried by helicopters and fire trucks (using a drag and drop approach with a computer mouse). The participant operates in a dynamic environment in which fire becomes more intense (size of flames) and spreads faster depending on the wind direction and wind intensity (both demarcated by a compass). The fire trucks and helicopters that the participant guides are set to carry a limited amount of water. The fire trucks and helicopters can be refilled with water at clearly marked water supply sites on the computer screen. Users can only see $\frac{1}{4}$ of the game space at a given time, and must click on a map on the left side of the screen to move to other views of the game (i.e., other parts). This helps establish multiple demands of the DDM environment to consider when playing the game. The program produces a task performance score at the end of each trial, determined by the percentage of landscape that remained unburned.

The NFC has been used to study decision making of individuals (Cañas et al., 2003) and groups (McLennan, Holgate, Omodei, & Wearing, 2006). In a past study, individual task performance on the NFC was significantly related to decision making quality as rated by an external expert (r = .62, Clancy et al., 2003). A composite of the percentage of landscape unburned for the three trials was used as a measure of task adaptive performance, which will serve as the dependent variable.

Alternative Uses Test: Measuring Divergent Thinking. The fluency results from The Alternate Uses Test (AUT) were used to measure divergent thinking (Guilford, Christensen, Merrifield, & Wilson, 1978). The AUT requires one to list as many possible uses for a common item (such as a brick, a rubber band, a paperclip, a newspaper, or shoe). This is a common test of divergent thinking which is a label given to a collection of terms which include elaboration, fluency, flexibility, redefinition, and originality (Guilford, 1956). In this study participants were asked to think of as many uses for a "brick" and a "paper clip" and were provided with four minutes per item to complete their lists. The total number of items generated was used as the score for divergent thinking.

Go/NoGo Paradigm: Measuring Focused Attention. Consistent with previous research examining the exploration/exploitation dilemma (McClure, Gilzenrat & Cohen, 2005), the Go/NoGo test was used to measure exploitation. This test employed a standard go/no-go paradigm in which participants press a response key as fast as possible when presented with a "go" stimuli. Conversely, the participant must desist from pressing a key when presented with "no-go" stimuli. This task used 6 target stimuli, presented in the form of shapes (squares with different textures 3 × 3 cm) in which two of the squares are "go" targets and the remaining 4 are "no-go" targets. Participants must memorize the two patterns that are to be "go" stimuli. Then one of the six squares is presented and the participant must decide which kind of stimuli it is (a Go or No/Go).

The go/no-go paradigm has been widely used to measure response inhibition (Garavan, Ross, Murphy, Roche, & Stein, 2002; Laurens, Ngan, Bates, Kiehl, & Liddle, 2003). This paradigm has been used on the Test of Attentional Performance (TAP) as a measure of focused attention (Zimmermann & Fimm, 2002). This study employed 60 trials and the time between the presentation of the target and the response was measured and stored at the millisecond level. Consistent with previous research (Konig, Buhner, & Murling, 2005), mean reaction time for correct response times were used to measure exploitation ability.

The Stroop Task: Measuring Cognitive Flexibility. The Stroop Task (Stroop, 1935) is often used to measure aspects of cognitive control and flexibility. The word-color Stroop Task presents a series of font colors in which an incongruent word of a color is presented (i.e. the *word* green written in *red* font). The participant must choose the *word* red instead of choosing the word green, which is the stronger response (MacLeod, 1991). There were 60 total trials, with 30 congruent and 30 in-congruent trials. Reaction times for 60 trials were recorded at the level of milliseconds were used to determine performance of cognitive flexibility.

Intelligence Tests

The Basic Word Vocabulary Test: Measuring Crystallized Intelligence. The Basic Word Vocabulary Test has been previously correlated with other standardized measures of verbal ability, including the Sequential Tests of Educational Progress and the School and College abilities Tests (the STEP and the SCAT respectively). Total correct responses (out of 40) were used to measure a form of verbal crystallized intelligence (Dupuy, 1974).

The Card Rotations Test: Measuring Fluid Intelligence. The Card Rotations Test was used as a measure of visual spatial intelligence (Ekstrom, French, & Harman, 1976). The test consists of two sections each lasting three minutes. Subjects were asked to look at a two dimensional shape on the left hand column of the screen. They must determine whether the eight figures to the right were rotated within the plane or are mirror images of the primary shape. The total number of correct responses was used to measure visual spatial intelligence.

Results

Descriptive Statistics and Bivariate Correlations

Data from the 181 participants provided scores for task adaptive performance (M = 264.13, SD = 6.73), variables contributing to the formative construct of Individual Ambidexterity (divergent thinking: M = 21.6, SD = 8.76; focused attention: M = 1361.36, SD = 31.20; cognitive flexibility: M = 1332.90, SD = 233.86), and measures of fluid intelligence (M = 32.34, SD = 3.25) and crystallized intelligence (M = 170.02, SD = 24.58).

Each of the independent variables (divergent thinking, focused attention, and cognitive flexibility) and both measure of intelligence (fluid and crystallized) demonstrates a positive and significant relationship with the dependent variable (task adaptive performance), consistent with existing theory (See Table 2). In addition, there are three small to moderate significant correlations between the predictor variables: focused attention and cognitive flexibility ($r = .20$, $p < .001$), cognitive flexibility and fluid intelligence ($r = .19$, $p < .05$), and crystallized intelligence and fluid intelligence ($r = .16$, $p < .05$). Consistent with Nunnally (1978), the reliability estimates, which range from .70 to .82, are all above .70, suggesting adequate reliability for each of the measures. In addition, effect sizes (r^2) for the measures ranged from .02 to .20.

TABLE 2. Bivariate Correlation Matrix

Measure	1	2	3	4	5	6
1. Task adaptive performance	—					
2. Divergent thinking	.23***	—				
3. Focused attention	.15*	.11	—			
4. Cognitive flexibility	.32***	.11	.20***	—		
5. Crystallized intelligence	.24***	.14	−.07	.03	—	
6. Fluid Intelligence	.45***	.12	.09	.19*	.16*	—

Note. n = 181. *p < .05. **p < .01. ***p < .001.

TABLE 3. Summary of Regression for Predicting Task Adaptive Performance

Variable	β	R^2	ΔR^2
Model 1			
Crystallized intelligence	.17**	.23***	—
Fluid intelligence	.42***		
Model 2a			
Crystallized intelligence	.17**	.26**	.03**
Fluid intelligence	.42		
Divergent thinking	.17**		
Model 2b		.25*	.02*
Crystallized intelligence	.17**		
Fluid intelligence	.42		
Focused attention	.14*		
Model 2c		.29***	.06***
Crystallized intelligence	.17**		
Fluid intelligence	.42		
Cognitive flexibility	.25***		
Model 3		.33***	.10***
Crystallized intelligence	.17**		
Fluid intelligence	.42		
Individual ambidexterity	.33***		

Note. n = 181.
*p < .05. **p < .01. ***p < .001.

Table 3 shows the regressions chart for all models. Standard linear regression models were used to measure the impact of each variable on task adaptive performance. *Hypothesis 1* sought to demonstrate that two forms of intelligence, crystallized and fluid, explained significant variance on the task adaptive performance. Therefore, both were included in Model 1 as a way to assess general cognitive intelligence. Combining the verbal and spatial measures of intelligence was used to approximate a general cognitive intelligence reflecting both crystallized (verbal) and fluid intelligence (spatial) (Cattell, 1963; Horn, 1998). In Model 1 within Table 3, both forms of intelligence are regressed on task adaptive performance and results indicate 23% of variance is explained by these measures. Therefore, Hypothesis 1 is supported.

Hypotheses 2–4 sought to measure whether the individual variables of individual exploration as measured by divergent thinking, individual exploitation as measured by focused attention, and cognitive flexibility would demonstrate significant variance beyond intelligence when regressed on the measure of task adaptive performance. Model 2a shows that *H2* was upheld as individual exploration as measured by divergent thinking demonstrated 3.0% unique variance beyond the measures of intelligence (ΔR2 $= .03 = p < .001$; $\beta = .17$). Model 2b shows that *H3* was supported as individual exploitation as measured by focused attention demonstrated 2.0% unique variance beyond intelligence ($\Delta R^2 = .02 = p < .01$; $\beta = .14$). *H4* was supported as Model 2c shows cognitive flexibility with 6.0% unique variance beyond intelligence ($\Delta R^2 = .06, p < .001$; ($\beta = .25$).

Hypothesis 5 sought to measure whether the formative construct of *IA* would demonstrate significant variance beyond intelligence when regressed on the measure of task adaptive performance. Theory helps support the creation of a formative construct for *IA*. Formative constructs are a composite of multiple measures (MacCallum & Browne, 1993). Since multiple measures (i.e. exploration through divergent thinking, exploitation through focused attention and cognitive flexibility) create *IA*, a formative or composite measure is ideal instead of a reflective construct (Jarvis, MacKenzie, & Podsakoff, 2003). Results are presented on Model 3 within Table 3. The addition of the *IA* formative construct entered listwise provided 10.0% unique variance on the measure of task adaptive performance beyond intelligence (ΔR2 $= .10, p < .001$). Therefore, Hypothesis 5 was supported.

In sum, our results suggest intelligence explains 23% of the variance on task adaptive performance. Furthermore, our results suggest each of the three variables comprising the construct of individual ambidexterity, divergent thinking (ΔR2 $= .03 = p < .001$; $\beta = .17$), focused attention (ΔR2 $= .02 = p < .01$; $\beta = .14$), and cognitive flexibility (ΔR2 $= .06, p < .001$; ($\beta = .25$), explain additional variance beyond intelligence on task adaptive performance. Last, our results suggest the formative construct of individual ambidexterity explain 10% unique variance in task adaptive performance.

Discussion

How organizations and their members ambidextrously mange the tradeoff between exploration and exploitation is seen as a foundational theory in the strategic management of organizations (Raisch et al., 2009). Increasingly, scholars have noted the important role that individuals play in producing firm or unit level ambidexterity. The present study responds to a growing number of calls to provide empirical data on individual-level ambidexterity (Mom et al., 2007, 2009; Raisch et al., 2009). While it has been suggested that individual differences may impact one's capacity to be ambidextrous, this proposition remains untested (Gupta et al., 2006). Specifically, this study meets this need through implicit objective measures of individual abilities instead of relying on self-reports (Mom et al., 2007, 2009).

The results from this study demonstrate how individual difference variables may impact individual ambidexterity, having important implications for organizational behavior. Each of the individual variables measured demonstrate unique variance beyond intelligence. In addition, the strength of the relationship between four variables (fluid intelligence, cognitive flexibility, crystallized intelligence, and divergent thinking) and the dependent variable of task adaptive performance exceeded the recommended minimum effect size of .04 (Ferguson, 2009). Most notably, the formative construct of *IA* predicted success in a real-time dynamic decision-making task beyond measures of intelligence. While the predictive power of *IA* remains relatively small, findings suggest that individuals may have measureable abilities to better predict performance within dynamic tasks that require the simultaneous use of exploration and exploitation.

While narrow in scope, the results from this study help to advance an interdisciplinary conversation regarding the individual's role in managing the ongoing tradeoff between exploitation and exploration. Beyond being a psychological individual differences study, we ground this in the organizational context in which ambidexterity has been identified as a construct with tremendous utility (Tushman & O'Reilly, 1996). In so doing, scholars contributing to their particular fields, whether it be psychology (Laureio-Martinez et al. 2010), neuroscience (Aston-Jones & Cohen, 2005; Cohen, McClure & Yu, 2007) or organizational behavior (Mom et al. 2009), can widen the breadth and depth of future inquiry.

Limitations and Strengths

This research is an initial step in proposing a new construct, and therefore a great deal of future work toward validation is necessary, which is beyond the scope of this section. However, current study limitations are noted regarding generalizability of results. One such limitation is the use of an entirely undergraduate population when inferring potential impact of a managerial-based construct of a presumably older population. Another limitation suggests results must be viewed with caution, as laboratory based decision-making studies do not fully capture real life decision making (Dawes, 1988).

There are particular limitations associated with the use of a real-time microworld as a testing platform. Such a microworld provides a narrow context from which to generalize results about organizational ambidexterity. Current individual ambidexterity studies test manager's retrospective subjective accounts of exploration and exploitation behavior across tasks and relationships over time (Mom et al., 2007). The current study focuses narrowly on a singular task in real time that requires both explorative and exploitative behavior in order to succeed. Therefore, one must be reminded of the narrowness of the time scale and within-task features when making assumptions about subsequent workplace behaviors.

On the contrary, microworlds have been lauded as a method to "bridge the gap" between laboratory and field studies (Brehmer & Dörner, 1993). Microwords intend to simulate the conditions encountered by actors in modern organizational life rather than replicate accurate surface conditions (Brehmer & Dörner). Therefore, the explicit context of playing the role of fire chief is not a limitation to the applicability of the real-life organizational context. It serves as a way to provide a controlled and uniformed dynamic environment within which to test functional relationships between variables (DiFonzo, Hantula, & Bordia, 1998). Given DDMs are the predictive context in which *IA* will be most necessary, the use of a microworld provides the appropriate context in which to extend existing theory (Smith et al., 2010).

Implications and Future Research

Our results suggest individual abilities may help explain ambidextrous behaviors. Furthermore, it serves to reinforce that *IA* should be considered in context specific ways, as previously suggested in the literature (Raisch et al., 2009). The present study was clearly testing the ambidexterity construct *within* a dynamic real-time task. Therefore, future research should be explicit in assessing *IA* according to contextual features which may include, but are not limited to: time pressure, levels of dynamism and complexity, and whether it is challenged within-versus-between tasks.

An individual differences perspective has practical implications for *IA*. For instance, many organizations are increasingly attempting to embed *contextual* ambidexterity as a part of the culture—where individuals are encouraged and supported to simultaneously balance exploration and exploitation as necessary (Gibson & Birkinshaw, 2004). Within studies concentrating on *contextua*l ambidexterity, the role of the individual is largely neglected and yet may play a significant role in better understanding how to select, train and develop employees to follow through on strategic initiatives in dynamic environments.

Future research should test *IA* in real world organizational contexts. It is possible that the cognitive micro-foundations of ambidexterity predict ambidextrous behavior across time and context. While it would be valuable to test this in further laboratory settings, ultimately it needs to be assessed in the field. Future research should test relationships between ambidextrous ability and survey research from self-reports (Mom et al., 2007) and that of external raters. Another contribution will be to investigate if the presence of *IA* as an ability scales upward to impact the ambidextrous behavior of teams, units and organizations (Laureiro-Martinez et al., 2010; Mom et al., 2007, 2009; Simzek, Heavey, Veiga, & Souder, 2009).

Conclusion

This was an initial exploratory study of individual-level ambidexterity in a specific dynamic context. Such a task is relevant as individuals in organizations face an increasing amount of change and uncertainty (Schreyögg & Sydow 2010; Zollo & Winter, 2002). These conditions have lead to an increase in the demand for dynamic decision making in organizations. It has been suggested that dynamic decision making contexts represent the areas within organizational life where individual ambidexterity will be most necessary (Smith et al., 2010). These demands have raised the value of *IA* as a potential ability for successful adaptation. Understanding more about *IA* will help to prepare individuals and the organizations in which they inhabit to flourish in the future.

AUTHOR NOTES

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