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SEEING THE FOREST FOR THE TREES: EXPLORATORY LEARNING, MOBILE TECHNOLOGY, AND KNOWLEDGE WORKERS' ROLE INTEGRATION BEHAVIORS

JEAN-NICOLAS REYT
McGill University

BATIA M. WIESENFELD
New York University

Role integration is the new workplace reality for many employees. The prevalence of mobile technologies (e.g., laptops, smartphones, tablets) that are increasingly wearable and nearly always "on" makes it difficult to keep role boundaries separate and distinct. We draw upon boundary theory and construal level theory to hypothesize that role integration behaviors shift people from thinking concretely to thinking more abstractly about their work. The results of an archival study of Enron executives' emails, two experiments, and a multi-wave field study of knowledge workers provide evidence of positive associations between role integration behaviors, higher construal level, and more exploratory learning activities.

Social roles, and how they relate to one another, are shifting in the modern workplace. Ubiquitous and rapidly evolving mobile technologies such as smartphones and tablets (and increasingly wearable mobile devices such as wrist technologies) allow people to work any time, anywhere, and on any task. Knowledge work, which involves skilled mental labor that is generally information-intensive, has been most acutely transformed by these capabilities because they increase access to knowledge and information. Mobile work practices and tools have altered worker and organizational demands, norms, preferences and abilities, but generally in the direction of greater role integration. Increasingly, people work all the time, everywhere, and on everything (e.g., Mazmanian, Orlikowski, & Yates, 2013). Moreover, due to pervasive "bring your own device" policies, knowledge work is done on personal devices that mix business and non-business use (Cisco, 2013). In short, these technologies have the effect of diminishing time, space and social role boundaries, rendering roles increasingly integrated, decontextualized, overlapping and combined (e.g., Mazmanian, Orlikowski, & Yates, 2005; Middleton, 2008; Schlosser, 2002; Towers, Duxbury, Higgins, & Thomas, 2006).

Knowledge workers, who are likely to experience these role integration pressures most acutely, are also the employees whose mental mindsets and intellective abilities are especially relevant to their work. They tend to be the workers primarily responsible for steering organizational learning efforts. Organizational learning is critically important to enable adaptation, especially in highly dynamic contexts. How does role integration shape the way knowledge workers think and behave on the job? A key aspect of role integration is how it taxes psychological resources and demands adaptation. We draw upon boundary theory, construal level theory, and organizational learning research, which share a common conceptual foundation in bounded rationality (Simon, 1955) and notions of limited psychological resources, to suggest that role integration behaviors may influence knowledge workers' mental mindsets. In particular, these behaviors may raise workers' construal level, leading to more abstract thinking as people try to adapt to overlapping roles. We suggest that higher construal, in turn, may promote exploratory learning behavior (i.e., the development of new skills and capabilities that enable adaptation to changing contexts).

We empirically explore the relationships between role integration, construal level, and organizational

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learning activities in four studies. First, we establish the relationship between role integration behaviors and construal level in an archival study utilizing a large email corpus. We then explore the causal links between role integration and construal level, and between construal level and exploratory learning, in two experiments. Finally, we test the relationship between role integration, construal level, and exploratory learning behaviors in a multi-wave field study of knowledge workers engaging in role integration using mobile technologies that was conducted over four months (see Figure 1 for an overview of our hypotheses and studies).

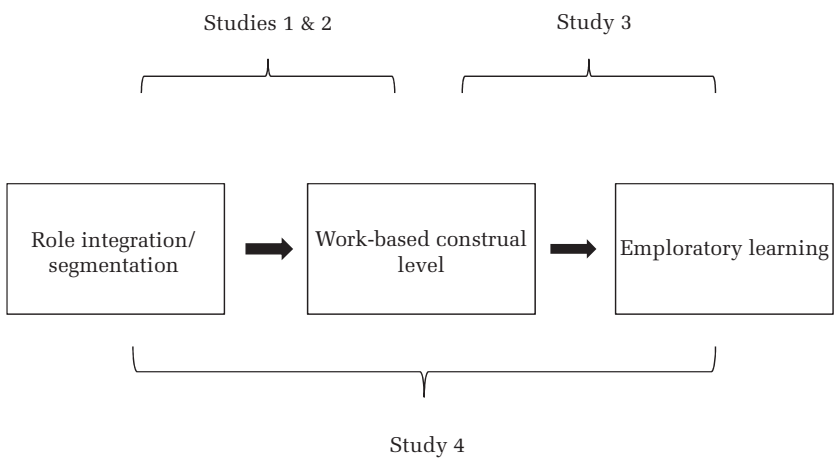
This research contributes to the existing literature in a number of ways. We extend boundary theory research by exploring a key cognitive mechanism underlying the effects of role integration activities (i.e., construal level), and by expanding the scope of role integration outcomes. In particular, whereas prior work has focused on attitudinal outcomes of role integration, such as job satisfaction, commitment and work-family conflict, we argue that role integration may have heretofore unexplored cognitive and behavioral implications. We also contribute to research on exploratory learning. Exploratory learning enables adaptation through cognitive processes but existing literature seldom examines the cognition theorized in that work. We advance the literature by evaluating the *content* of knowledge workers' mental mindsets (with respect to level of abstraction versus concreteness) and link this to their learning activities. We also extend construal level theory beyond its predominant focus on mental representations of discrete objects and events to consider mental representations of key social roles. In so doing, we provide a platform for theorizing about how construal level shapes organizational behavior.

BOUNDARIES AND MENTAL MINDSETS

Individuals enact various role identities in their daily lives. Roles are contextualized with respect to time, space, and social interaction partners. For example, people may enact their organization member role at their office during work hours, but enact their family member role at home. Role identities are characterized by specific attitudes and behavior patterns and they are designed to fit each domain's rules and expectations. For example, at home family members may be expected to be sensitive and affectionate with each other, but employees may have to be competitive and self-reliant at the office (Greenhaus & Beutell, 1985). A manager may be submissive with demanding clients or bosses, but dominant with subordinates.

Boundary theory is a growing stream of research in management describing the demarcations that delimit the role identities that people enact across various social domains, and how people transition from one domain to another (Ashforth, Kreiner, & Fugate, 2000; Clark, 2002; Kossek, Noe, & DeMarr, 1999; Michaelsen & Johnson, 1997; Nippert-Eng,

FIGURE 1
Conceptual Framework



1996; Rau & Hyland, 2006; Rothbard, Phillips, & Dumas, 2005). Boundary theory refers to how people make "micro" role transitions: those involved in everyday movement between roles such as "work" and "home" roles, or at-work transitions such as from supervisor to subordinate or from Team A to Team B (Ashforth et al., 2000). Traditionally, when people transition from one social domain to another, contextual cues bring relevant role identities into salience (Turner, 1982). Thus, an employee who goes back home after a day at work, or enters a conference room to make a presentation to a client, must switch "cognitive gears" (Louis & Sutton, 1991) by adapting to expectations in the new domain in order to avoid behavioral discrepancies. Out-of-place behaviors (e.g., being affectionate with a coworker, being bossy with a spouse or supervisor) occur when expectations associated with a specific role are misinterpreted or violated, which is often costly with respect to reputation and social relationships.

According to boundary theory, roles may vary along a continuum from highly segmented (i.e., distinct and separate) to highly integrated (i.e., overlapping and combined) both psychologically and behaviorally (e.g., Ashforth et al., 2000; Edwards & Rothbard, 1999; Hartmann, 1997; Nippert-Eng, 1996). When roles are more segmented, the various responsibilities that occupy a person's life are more distinct and separate. For example, workers may dedicate specific time, space and equipment to use for each task. Conversely, when roles are more integrated, the various responsibilities that are part of someone's life are relatively more overlapping or combined. For example, the same smartphone is used for work and personal activities (sometimes simultaneously), and workers may compose a work email while watching a child's soccer game or text colleagues working on one team project while attending a client meeting for a different team project. In sum, roles are highly segmented when role-associations (e.g., behaviors, attitudes) are metaphorically "left at the door" when disengaging from one social domain and engaging in another one (Olson-Buchanan & Boswell, 2006), while roles are highly integrated when observers and workers themselves find it difficult to contextually or behaviorally distinguish the social domains a worker operates in.

Boundary theory recognizes that psychological resources are limited and therefore people must enact different types of role boundaries to manage the different kinds of relationships between their roles (Ashforth et al., 2000). Role segmentation and integration behaviors have benefits and costs associated with their effect on role boundaries (Ashforth et al., 2000). Greater role segmentation requires erecting relatively impermeable ("thick") boundaries with respect to time, space, and social interaction partners, and crossing such boundaries is quite effortful (Nippert-Eng, 1996). Therefore, interruptions and blurring of roles are less likely, and movement between relatively segmented roles is more infrequent and salient (to role occupants but also to observers) than movement between more integrated roles (Ashforth et al., 2000). On the other hand, more integration makes role boundaries thinner and more permeable. This allows people to fluidly move from one role to another but the resulting overlaps and blurring of roles increases the likelihood of confusion, interruptions, role "contamination", and competing demands (like those associated with taking a cell phone call from one's supervisor while enjoying dinner out with one's spouse on a Saturday night; Ashforth et al., 2000; Rau & Hyland, 2006).

Mobile devices (e.g., smartphones, tablets, netbooks) and mobile computing (e.g., "cloud" storage) are key enablers of role integration especially for knowledge workers. They do this by considerably broadening the range of job-related tasks that can be performed anytime and anywhere. Quantitative (e.g., Leung, 2011; Richardson & Thompson, 2012) and qualitative (e.g., Jarvenpaa, Lang, & Tuunainen, 2005; Mazmanian et al., 2005; Towers et al., 2006) studies have described the boundary-blurring behavior associated with mobile technology use. These include overlapping conversations (e.g., Cameron & Webster, 2005; Schlosser, 2002; Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007), interruptions (e.g., Fenner & Renn, 2010; Renneker & Godwin, 2005), and multi-tasking (e.g., Benbunan-Fich & Truman, 2009). However, mobile work research has yet to explore the cognitive and organizationally-relevant behavioral outcomes of such integration activities.

Most of the attention in the boundary theory literature is focused on describing boundary management strategies (e.g., Ashforth et al., 2000; Nippert-Eng, 1996), their antecedents (e.g., Edwards & Rothbard, 1999; Rau & Hyland, 2006), employee preferences for segmentation or integration, and how such preferences interact with organization-level policies (e.g., Kossek, Lautsch, & Eaton, 2006; Kossek et al., 1999; Kreiner, 2006;

Rothbard et al., 2005).[1] Work on boundary management strategies and preferences depicts workers' efforts to control their role integration behaviors. However, recent evidence suggests that mobile technologies produce an "autonomy paradox" in which a worker's role integration behaviors are constrained by social norms and the preferences and behavior of their interaction partners, limiting workers' ability to act on their strategies and preferences (Mazmanian et al., 2013). Most likely, a worker's role integration behaviors are a function of a complex interaction between the person and the context, with strong situations (such as social norms, the expectations and behavior of social interaction partners, and incentives) attenuating the effect of individual desires and boundary preferences while weak or ambiguous situations allow individual preferences to dominate (Weiss & Adler, 1984).

Prior research has shown that role boundaries are *enacted*—indeed "boundary work" refers to the effortful initiatives taken by people to enact role boundaries in more segmented or more integrated ways (Kreiner, Hollensbe, & Sheep, 2009; Nippert-Eng, 1996). This research assumes that role boundaries are important psychologically (Ashforth et al., 2000), yet we know little about how enacting more integrated or more segmented roles shapes the way people think—their mental representations. We suggest that in order to understand whether and how role integration behaviors influence knowledge workers' activities on the job, we must explore how role enactment shapes the way people conceptualize their roles.

Construal level theory (e.g., Trope & Liberman, 2010) is a highly influential theory in social psychology that offers a vocabulary and powerful conceptual foundation for understanding individuals' mental representations. The theory suggests that mental representations are structured in a hierarchy, and that domain-specific mental representations can be characterized along a continuum from more abstract (higher construal) to more concrete (lower construal). Low-level construals are specific and contextualized, capturing peripheral and therefore subordinate features of targets. Conversely, high-level construals are abstract, schematic, and decontextualized, capturing superordinate characteristics of targets and thus lying higher on a conceptual hierarchy defined with respect to centrality, general meaning, and valence. The old adage that "it is hard to see the forest for the trees" reflects this distinction; seeing the forest reflects higher construals while seeing the trees reflects lower construals. The saying also highlights the trade-offs in construals associated with bounded rationality: in order to see the forest we must surrender our capacity to see each individual tree, and when examining one tree we lose the ability to pay attention to the whole forest.

Activities are fundamental to roles and behavioral expectations define them in large part (Biddle, 1979). Thus, applying construal level theory to roles requires consideration of how actions also form hierarchies that are defined by their level of abstraction (Vallacher & Wegner, 1989). Each action can be thought of with respect to the superordinate and more abstract conceptualization of *why* that action is performed or the subordinate details of *how* that action is performed, with more abstract representations of actions being more general, central and incorporating value while more concrete representations contain more detailed, specific and peripheral features (Liberman & Trope, 1998; Vallacher & Wegner, 1989). For instance, when thinking about a common work role activity such as "attending a meeting," a concrete and contextualized construal might be "convening in a conference room with colleagues" while a more abstract and decontextualized one might be "becoming well-informed". The latter results in a loss of information about the fact that a meeting is involved—people could also become well-informed by reading a book or attending a class—but it retains more central information about the general meaning and valence of the action. In sum, abstract construals reflect individuals' implicit choices regarding which features of an object or activity are central and which are peripheral, with the abstraction process enabling goal-relevant features (*why*) to take center stage while more practical features (*how*) may fade from salience (Trope & Liberman, 2010).

Construal level theory has generally been applied to people's mental representation of targets that are tangible, such as specific objects, activities, or

[1] For example, Kossek et al. (1999) explored the consequences of the fit (or misfit) between individual employees' boundary management preferences and their organizational context. Edwards and Rothbard (1999) empirically investigated the attitudinal outcomes of "person–environment fit" on well-being, while Kreiner (2006) investigated its effects on role conflict, stress, and job satisfaction. In an effort to clarify the mechanism linking individual-level integration preferences and organizational-level policies, Rothbard and Dumas (2005) explored the moderating effect of employees' desire for segmentation on the relationship between organizational work–family policies (e.g., onsite childcare, flextime), job satisfaction, and organizational commitment.

people (Liberman & Trope, 1998, 2008; Trope & Liberman, 2003). While roles are less tangible, boundary theory suggests that roles also have boundaries with regard to time, space, and social interaction partners (Ashforth et al., 2000). We suggest that these psychological boundaries enable people to mentally represent their roles more abstractly or more concretely just as they do events, objects, and people. Moreover, boundary theory and related notions of boundary work and boundary preferences suggest that role boundaries are relatively stable. Therefore, mental representations of roles can be thought of as domain-specific—associated with the role and triggered by psychological engagement with the role, rather than reflecting either a dispositional orientation that people apply consistently to every situation or a momentary orientation that changes continually within role.

We suggest that greater role integration behaviors will elicit more abstract mental representations; in other words, higher construal level. Two assumptions underlie our assertion: bounded rationality and functional adaptation. First, construal level theory is based on the notion that cognitive resources are bounded. When people have broader mental horizons, they do not have the resources to process as much detail and complexity (Trope & Liberman, 2010). Indeed, this dynamic may originate in the brain, where brain activity moves along an axis in the medial pre-frontal cortex as psychological processes become more or less abstract (Amodio & Frith, 2006). Role integration behaviors enable bridging and overlapping of roles rather than sharp focus on a single role domain, and thus necessarily broaden the individuals' scope to take a wider set of contextual factors into account. This taxes cognitive resources, forcing people to relinquish attention to detail. Therefore, the broader scope of role integration necessitates greater abstraction in the form of higher construal levels.

When roles are highly segmented they are enacted sequentially rather than simultaneously, so the context and one's social interaction partners provide clear cues to direct behavior. Thick role boundaries associated with enacting segmented roles limit conflicting cues, buffer people from interruptions, and diminish the salience of competing demands, pressures and priorities when they are within any one role (Ashforth et al., 2000). Thus, role segmentation narrows role occupants' focus on their immediate, specific, and actionable role demands. This prompts them to move down the hierarchy of action; by eliminating overlaps and thus uncertainty regarding what should be done and why, role occupants can focus on how to accomplish their goals within a single role domain. Thus, the thick boundaries associated with role segmentation behaviors enable more concrete, feasibility-oriented lower-level construal by reducing uncertainty and confusion.

However, when roles are more integrated then multiple roles and all of their demands are simultaneously salient, leaving the role occupant to make the difficult choices about how to direct their energy and attention. People who must cope with these competing pressures are likely to functionally adapt by relying upon mental strategies that enable them to prioritize, make appropriate trade-offs, and identify opportunities for synergy. Higher construals are essential to these capabilities (Trope & Liberman, 2010). For example, higher construals increase the likelihood that people will focus on central, goal-related features (Trope & Liberman, 2010), distinguish signal from noise (Nussbaum, Liberman, & Trope, 2006), and be capable of making comparisons between unalignable features (Wakslak & Trope, 2009). These are the capabilities that enable people to set priorities, make trade-offs and identify synergies. Without these capabilities, more integrated roles will be experienced as more stressful and depleting. Thus, higher construals are more functionally adaptive for people who engage in greater role integration behavior.

Hypothesis 1. Role integration behaviors will be positively associated with construal level (i.e., more abstract mental representations of work).

Theory and research on construal level effects suggest that causal relationships are typically reciprocal—for example, distance raises level of construal but higher construals shape psychological distance (Trope & Liberman, 2010). The relationship between behavior and cognition is also often reciprocal; thus, just as workers under normative and social pressure to integrate roles are likely to cope by mentally representing their roles more abstractly, it is also possible that workers who mentally represent their roles abstractly may be more likely to integrate their roles, such as by using mobile technologies in an integrative way. However, based on role theory we expect that one direction of causality, in which role behavior shapes construal, will be primary. In particular, roles are composed of patterned behaviors characteristically performed by people in a given context or situation (Biddle, 1979).

Role theory suggests that people must be socialized into roles and their behavior is patterned by the expectations and norms associated with those roles (Mead, 1934). Likewise, role integration behaviors must be socially negotiated with role alters to follow norms and conform to others' expectations (Kreiner et al., 2009). In sum, roles are socially and contextually constrained and thus less individually controllable than cognition. Therefore, we expect contextually-defined role integration behaviors to influence construal level more powerfully than the reverse.

CONSTRUAL LEVEL AND EXPLORATORY LEARNING ACTIVITIES

Cognitive representations have proven to be a critical determinant of important organizational behavior phenomena (Fiol & Huff, 1992; Huff, 1990; Tversky & Kahneman, 1986; Walsh, 1995). Bounded rationality, in particular, has spawned an influential stream of research on organizational learning (Levitt & March, 1988). Learning refers to the development of routines and processes that create, capture, transfer, and mobilize knowledge (Nonaka & Takeuchi, 1995). These activities may be directed toward improving existing products and processes or developing new ones, both at the individual and the collective level. Thus, learning is organizationally important because it is essential to adaptation. Existing research on organizational learning distinguishes between exploitation activities (i.e., learning from experience to improve and refine existing processes) and exploration activities (i.e., discovering, creating and experimenting with new opportunities; March, 1991). While exploitation is focused on improving mean performance, exploration is associated with generating variance from which adaptive alternatives can be selected (March, 1991). Prior theorizing (Gavetti & Levinthal, 2000) suggests that exploratory learning is distinct with respect to process (i.e., utilizing a cognitive rather than experiential process to evaluate alternatives) and the alternatives considered (i.e., exploratory learning considers a broader set of alternatives, and ones that diverge more from prior experience). Exploratory learning is more rare than exploitative learning because it is more uncertain and the success rate is lower (March, 1991).

There is debate about the relationship between exploratory and exploitative learning (Gupta, Smith, & Shalley, 2006), with some scholars conceptualizing them as competing (e.g., March, 1991) and others viewing them as orthogonal (e.g., Katila & Ahuja, 2002). Exploratory learning is especially relevant to innovation, which is a critical outcome of knowledge work, and is key to organizational survival (Levinthal & March, 1993). Mental representations are thought to be particularly relevant for exploratory learning, which is sometimes even termed "cognitive choice" (Gavetti & Levinthal, 2000). In particular, whereas exploitation relies upon reinforcement learning processes and prior experience (i.e., actions are tried, their outcomes are experienced, and then actions are revised), exploration uses cognitive representations of the world to generate a broader set of real and hypothetical alternatives (Gavetti & Levinthal, 2000). For these reasons, we focus on how workers' mental representation of their work roles relates to their exploratory learning activities.

While the learning literature has considered the *extent* to which mental representations are involved in learning (with mental mindsets being more involved in exploration than exploitation because alternatives are cognitively generated in the former; Gavetti & Levinthal, 2000), it has generally failed to consider or systematically assess what *type* of mental representations are involved in learning behavior. Research methods used to assess exploratory learning include archival studies of the actions of individuals and collectives, simulation studies, and a small number of qualitative case studies and experiments (Gavetti, Greve, Levinthal, & Ocasio, 2012), but these studies generally offer coarse proxies for cognition, or simulate the effect of different mental representations rather than measuring them. Prior research fails to consider whether the form of individuals' mental mindsets (from more abstract to more concrete) may shape the learning activities they engage in.

Construal level theory offers a conceptual model depicting how the content and consequences of people's mental mindsets may vary. We suggest that higher construal level will be associated with higher levels of exploratory learning activities because cognitive abstraction is critical to the analogical reasoning process that enables decision-makers to generate hypothetical alternatives and to vicariously learn from the experiences of others—both key sources of exploratory learning (Gavetti, Levinthal, & Rivkin, 2005; Huber, 1991). Research on construal level theory has repeatedly demonstrated that higher construals allow people to mentally transcend the here and now, which enables them to think hypothetically and vicariously (see Trope &

Liberman, 2010, for a review). That is, in order to imagine and cognitively assess a wide set of alternatives that diverge from one's own experience, it is essential to be able to create a simplified mental model that abstracts away superficial features and focuses on core aspects. Supporting this assertion is experimental evidence from research on creative cognition (e.g., Ward, 1994). This work suggests that properties represented more abstractly are less constraining than those anchored in specific instances. Therefore, representing a problem more abstractly enables more creative problem solving and leads to greater innovation (Ward, 1994). As described earlier, higher construal broadens individuals' mental horizons, focuses attention on central rather than peripheral features of the situation, and draws attention to strategic goals and away from feasibility concerns (Trope & Liberman, 2003). These capabilities enable exploration. Conversely, more concrete mental models include the distracting details, emphasis on experience, and focus on execution that constrains exploration. Thus, we suggest:

Hypothesis 2. Construal level will be positively related to employees' exploratory learning behavior.

To this point, we have drawn upon bounded rationality to hypothesize that role integration behaviors will lead to higher construal level (i.e., more abstract mental representations) and that higher construal level will lead to greater exploratory learning behavior. Synthesizing these arguments, we further suggest that role integration behaviors will be positively associated with exploratory learning through their effect on construal level.

As mentioned earlier, exploratory learning is a variance-seeking activity. Specifically, requisite variety must be generated, with some of the options generated offering more desirable outcomes, and actors adapt by selecting the options with the most appealing outcomes (March, 1991). In the organizational learning literature, internal variety (defined as access to divergent information, relationships, and alternatives; Schilling, Vidal, Ployhart, & Marangoni, 2003) has been repeatedly demonstrated to be positively associated with exploration across studies including archival research, experiments, and simulations (e.g., Gavetti, 2005; Schilling et al., 2003; Taylor & Greve, 2006). Frequently studied at the team level but also shown at the individual level, internal variety is thought to provide access to different knowledge domains, sources of advice, goals, and expectations, thereby expanding the decision-maker's scope and serving as key resources for exploration (Alexiev, Jansen, van den Bosch, & Volberda, 2010; Beckman, 2006; Brass, 1995; Mors, 2010; Schilling et al., 2003; Taylor & Greve, 2006). Integration is an essential complement to internal variety that enables learning (e.g., Jansen, Tempelaar, van den Bosch, & Volberda, 2009; Reagans & Zuckerman, 2001; Taylor & Greve, 2006). Without integration mechanisms, existing boundaries inhibit transfer of knowledge and perspective. Indeed, research suggests that it is the combination of internal variety and integration that is optimal (Lavie & Rosenkopf, 2006; Taylor & Greve, 2006).

At a collective level, integration may take the form of integration structures or interpersonal and network cohesion (e.g., Jansen et al., 2009; Lavie & Rosenkopf, 2006; Taylor & Greve, 2006). We suggest that within individuals, it is role integration behaviors that complement internal variety with integration, enabling the transfer of knowledge across different domains and cognitive nodes, that are an essential foundation for exploratory learning (Schilling et al., 2003). Role integration creates opportunities for the diverse sets of experiences, expectations, mindsets, and knowledge that people use in different contexts to be simultaneously salient, and abstraction eases transfer of knowledge into novel domains. Therefore, role integration is likely to enhance exploratory learning activities by broadening workers' focus, schemas and repertoire.

In contrast, employees with more segmented roles have more sequential rather than simultaneous awareness of different situations, bodies of knowledge, and influences. The spatial, temporal and social boundaries that role segmentation behaviors erect and maintain increase focus and concrete thinking. These cognitive processes undermine cross-fertilization and thus constrain exploratory learning.

Consider one's social network: role integration enables a broad and diverse network to be cognitively accessible simultaneously, while role segmentation makes portions of the network that are distant from a role less accessible by inserting relatively impermeable boundaries and narrowing focus. We suggest that mental abstraction is the cognitive mechanism or underlying psychological process enabling people to engage in the analogical reasoning that diminishes attention to superficial features in order to develop a mental representation of the deeper features that generalize across domains (Gavetti, 2005; Schilling et al., 2003). Thus:

Hypothesis 3. Construal level will mediate the positive relationship between role integration behaviors and employees' tendency to engage in exploratory learning behaviors.

STUDY 1

We explored the relationship between workers' role integration behaviors and their domain-specific construal level using a large corpus of emails sent by Enron executives between 1997 and 2002. In particular, we expected that role integration behaviors apparent in email sending patterns would be positively associated with employees' use of more abstract language in their professional emails—an unobtrusive indicator of their construal level at work that also has organizational relevance because it reflects information sharing behavior.

Over half a million emails sent by Enron executives were made public during the investigation that followed the company's collapse. This dataset is particularly interesting for organizational research because it contains real-life professional emails exchanged between employees over the course of several years. For this study, we used a cleaned corpus prepared by Shetty and Adibi (2005) containing 252,759 messages. We further removed 46,176 emails that were not sent from the "enron.com" domain as well as 27,530 duplicate emails that had the same sender, date/hour and body of text, arriving at a final set of emails that reflects information exchange and knowledge sharing among Enron employees over the time period.

The distribution of emails per sender in the dataset was exponential (as is typical in communication data), with many senders sending few messages while a smaller number sent many. We focused on the users who sent 100 emails or more during the five-year period the dataset covers in order to obtain a reliable assessment of email sending patterns and level of abstraction for each user. We analyzed only sent emails because writing and sending a work email is evidence of work role enactment. The data do not indicate when emails were opened and read, making role integration impossible to assess from received emails. We removed 12 accounts from our dataset either: (1) because they could not be linked to any employee in particular (e.g., automatic accounts sending calendar notices), or (2) because the accounts belonged to people who sent mostly automated messages. Enron employees often used several email addresses with different structures (e.g., lastname@enron.com, firstname.lastname@enron.com, middleinitial.lastname@enron.com, etc.). A list from Shetty and Adibi (2005) enabled us to identify 39 Enron employees who sent emails from at least two different addresses. We manually identified 16 other Enron employees who used at least two email addresses. We therefore merged the email accounts for 55 users who sent emails from more than one address. Overall, our analyses are based on the email messages from 236 Enron employees, who sent a total of 119,751 professional emails in our dataset.

Measures

Role integration behaviors. We measured work/non-work role integration with respect to integration across temporal boundaries between work and life roles. We do not have sufficient information about each Enron employee's different work roles to identify at-work role transitions in this dataset. To capture employees' role integration behaviors we assessed the proportion of total emails sent by each employee outside of traditional working hours (i.e., 9am to 5pm, Monday through Friday). Higher proportions reflect greater integration across temporal role boundaries and thus greater role integration for that worker.[2]

To validate our measure of role integration behaviors, we explored how it was associated with Blackberry smartphone use. In particular, in the last year of the dataset, a subset of email messages began to appear that indicated that they were sent via Blackberry. Messages sent via Blackberry do not always contain such signifiers and the set of Blackberry-indicated messages is small (and thus does not provide a reliable measure of role integration or construal level). However, because Blackberry keyboards are much less convenient to use than computer keyboards, it is reasonable to assume that employees using a Blackberry to send messages are likely to be integrating across spatial role boundaries because they are unlikely to send Blackberry messages from their offices or traditional work spaces (where more convenient keyboards are available). We compared Blackberry to

[2] The Enron dataset does not contain accurate time zones. Therefore, we individually coded 24,043 emails that were forwarded, and thus contain accurate email sending times hard-coded into the body of the message, to identify the accurate time zones of the emails.

non-Blackberry users and found that Blackberry use was significantly correlated with our role integration measure ($r = .203$; $p < .01$).

Construal level. To assess construal level, we measured the level of abstraction of each employee's sent email messages based on the Linguistic Category Model (LCM; Semin & Fiedler, 1991). The LCM suggests that words vary in level of abstraction, and thus texts can be assigned an LCM weighted score as a function of the abstractness of the type of words they contain. According to the LCM, the most concrete terms are descriptive action verbs (DAV) that provide an objective description of an observable action (e.g., to hit, to walk). Slightly more abstract are interpretative action verbs (IAV), which refer to a multitude of actions rather than to a specific observable behavior (e.g., to hurt, to help). Still more abstract are state action verbs (SAV), which refer to the emotional consequences of actions rather than to an action (e.g., to anger, to amaze). Even more abstract are state verbs (SV), which refer to enduring cognitive or emotional states (e.g., to hate, to love). Most abstract are adjectives (ADJ), which provide a general description that is stable and valid across situation and contexts (e.g., aggressive, helpful). Prior research has validated the use of the LCM as a measure of construal level (e.g., Freitas, Gollwitzer, & Trope, 2004; Fujita, Trope, Liberman, & Levin-Sagi, 2006).

In order to obtain an abstraction score for each user, we first removed all signatures, replies, and forwarded emails from the email texts. Once cleaned, some emails were too short to be included in our analyses because they did not contain a complete sentence. Thus, we conducted our linguistic analyses on all emails where the number of characters ranged from 50 to 1,500—a total of 78,231 emails.[3] Using a bag-of-words approach, we processed the whole dataset with a part-of-speech tagging algorithm coupled with an 80,000-word lexicon that enabled us to identify adjectives, verbs, and nouns, and we removed other types of words (e.g., prepositions, pronouns, etc.) from the dataset. We extracted a list of all the verbs in our dataset in order to manually identify the different types of verbs. We treated IAV and DAV as one category because context is necessary to reliably differentiate them (Coenen, Hedebouw & Semin, 2006). We weighted the words by their level of abstraction based on the LCM model (ADJ * 4 + SV * 3 + SAV * 2 + IAV + DAV) and divided by the total number of words (i.e., adjectives, verbs, nouns), resulting in a ratio in which higher numbers represent more abstract communication, indicating higher construal level.

Controls. Prior research has found that people who recalled and wrote about a time in which they were powerful were more likely to report higher construal level than those who recalled an instance in which they were powerless (Smith & Trope, 2006; Smith, Wigboldus, & Dijksterhuis, 2008). Therefore, we controlled for employees' hierarchical level in our analyses. Data from Shetty and Adibi (2005) enabled us to match 95 employees of our dataset with their job titles within Enron. In order to find job titles for the remaining employees, we used a spring/summer 1999 Enron Internal Phone Directory (purchased from eBay) containing hierarchical rank information, as well as other sources such as email signatures and LinkedIn profiles. Overall, we matched 226 employees (96% successful matches) with their job titles at the time the emails were sent. We used Diesner, Frantz, and Carley's (2005) hierarchy of Enron's job titles to assign a score reflecting employees' hierarchical level, following previous work on the Enron dataset (e.g., Hossain, 2009). Higher scores indicate higher levels in the hierarchy; specifically: (1) Associates, (2) Specialists, (3) Traders, (4) Managers, (5) Lawyers, (6) Senior Management, (7) Executive Management.

We also controlled for the number of emails sent by each user to ensure that the distribution of our dataset did not influence our dispersion indices and abstraction scores.

Results and Discussion

Table 1 reports the means, correlations, and ranges for all of the measures in our study. With respect to hierarchical level, the 226 Enron employees were distributed as follows: Associates (73), Specialists (26), Traders (13), Managers (24), Lawyers (22), Senior Management (58), Executive Management (10).

We tested whether there was a positive relationship between employees' role integration behaviors and their construal level (Hypothesis 1) using hierarchical regression. In the first step, we entered our two control variables: number of emails sent

[3] As a robustness check, we also coded the full set of emails that contained text written by the employee (i.e., deleting forwarded emails) and used those scores in our analyses. Results using this larger set of messages (N=105,041) were nearly identical in pattern and level of significance to those found using the constrained set of emails.

TABLE 1
Descriptive Statistics for all Variables (Study 1)

Variables	Mean	*SD*	Min	Max	1	2	3	4
1. Number of emails	507.4	821	100	5,508				
2. Hierarchical rank	3.49	2.169	1	7	–.018			
3. Role integration	.472	.17	.05	.982	–.135*	.101		
4. Construal level	.754	.074	.54	.958	.012	.232**	.259**	

Note: N = 226 for hierarchical rank and N = 236 for all of the other variables.
* $p < .05$
** $p < .01$

and hierarchical rank. In the second step, we added our measure of role integration as a predictor of the LCM abstraction measure.

Table 2 reveals that hierarchical rank is positively and significantly associated with construal level, consistent with prior findings linking power to construal level (Smith & Trope, 2006; Smith et al., 2008). These findings provide reassuring evidence that our linguistic analysis of the abstraction of professional emails is associated with a variable (power) that has been previously shown to shape construal level. Of far greater importance, role integration was significantly and positively associated with employees' construal level as measured by the abstractness of professional email communication, supporting Hypothesis 1.

The fact that Study 1 is an archival study of natural behaviors of executives in an organizational setting speaks to the external validity of the relationship between role integration behaviors and construal level. However, a notable limitation of the research design is our inability to verify the direction of causality (from greater role integration to higher construal level). Our archival measure of construal level—the level of abstractness of information exchanged via email by company employees—is inherently interesting as an indicator of organizational communication. Also, written communication has been validated as a measure of construal level in prior research (e.g., Freitas et al., 2004). However, the archival measures of construal level and role integration in this study are inherently limited and noisy, and they are only proxies for the underlying constructs we sought to assess. Furthermore, the role integration measure taps only one type of micro-role transition (work/non-work) and thus it is not clear whether our findings generalize to at-work micro-role transitions. Study 2 was designed to begin to address these limitations.

TABLE 2
Regressions of Construal Level and Role Integration (Study 1)

	Step 1	Step 2
Controls		
Number of emails	.007	.039
Hierarchical rank	.232*	.209*
Main effect		
Role integration	—	.229*
Adjusted R^2	.045	.092
Change in R^2	—	.047

Note: N = 226 for hierarchical rank and N = 236 for all of the other variables. The coefficients reported in each column are standardized β coefficients.
* $p < .01$

STUDY 2

Study 2 explores whether role integration is associated with construal level by priming participants' role integration or segmentation through a writing task and then measuring their construal level. The purpose of this experiment was to replicate our Study 1 findings in a different setting and with different measures, and to test the causal association between role integration and how abstractly people mentally represent their work.

Participants

One hundred working adults were recruited on an online platform where people participate in studies for payment. Three participants were dropped from the analyses for failing our attention check. Thus, 97 participants (40 women, age: M = 33.71, SD = 10.13) were included in the final analyses.

Procedure

Role integration/segmentation priming task. At the beginning of the study, we asked participants to make a list of at least five activities they typically perform in their work. Mobile technology and its effect on work roles were made salient for all participants at the start of the prime. Participants read, "In the modern workplace, mobile technologies (e.g., smartphones, tablets, laptops) are ubiquitous and job roles are complex." Participants in the integration condition (n = 49) were then told: "In particular, your work activities may be quite integrated (that is, overlapping and combined). Please describe the aspects of your work activities that are overlapping and combined (i.e. integrated)." Participants all wrote a paragraph in response, and they typically described the technologies, people and skill-sets that were common across their work activities. One of the examples provided by a telecommunications company employee was, "For some issues I might have to call a customer and while they are on the phone, I send Instant Messages to other colleagues." In the segmentation condition (n = 48) after making mobile technology salient participants were told, "In particular, your work activities may be quite segmented (that is, distinct and separate). Please describe the aspects of your work activities that are distinct and separate." Participants typically described the differences in technologies, places, and people between their various work activities. As an illustration, a research chemist explained, "The work that I do in the lab is hands on whereas the work I do with customers is always through email or phone."

Work-based construal level. As indicated above, behaviors are a central and defining feature of roles (Biddle, 1979) and people represent their actions hierarchically, ranging from more abstract and superordinate representations that are more general, central, and incorporate value to more concrete and subordinate representations that are relatively more detailed, specific, and practical (Vallacher & Wegner, 1987). To assess the level at which people mentally represent their work role, we drew upon action identification theory (Vallacher & Wegner, 1987), which serves as an important foundation for construal level theory (Trope & Liberman, 2010) and addresses how actions are identified, or mentally represented hierarchically. Construal level research has used Vallacher and Wegner's (1989) behavior identification form (BIF) to assess how abstractly actions are represented. The original BIF characterizes a set of 25 everyday non-work activities (e.g., brushing teeth) using a low-level description focused on *how* the action is performed and a high-level description focused on *why* the action is performed. For each activity, participants indicate which description best represents the behavior for them. In the BIF, an abstraction score is calculated by counting the number of high-level descriptions that are chosen. We created a work-domain specific adaptation of the BIF because the BIF assesses how abstractly people represent their behaviors and activities, which are the defining aspects of roles.

To create a measure of how abstractly people represent their work role, we selected 30 common knowledge work activities (e.g., preparing a report, attending a meeting, proofreading a document, etc.) from a database of job tasks developed by the US Department of Labor. Following Vallacher and Wegner's (1989) methodology, 40 pilot subjects were asked to provide as many descriptions as possible for each activity. The most commonly cited high- and low-level descriptions were used to build our work-based construal level measure.

We then administered our resulting measure to a separate test sample of 100 knowledge workers and retained the 18 items that had the highest item-total correlation (Cronbach's α = .92 for the test sample; see Appendix 1 for the entire scale). We used high and low-level activity descriptions as opposite anchors of six-point scales and asked participants to indicate the point along the scale that best described how they see that work activity. Half were reverse scored and all of the activities were displayed in random order, with responses averaged to construct our measure (Cronbach's α = .88 in the study sample).

Manipulation check. To ensure that our role integration prime successfully manipulated the integration of various work roles, we drew upon how role integration and segmentation are defined in prior research (e.g., Ashforth et al., 2000) and asked participants to rate the extent to which their work activities were: (1) "overlapping," (2) "combined," (3) "distinct," and (4) "separate" on Likert scales with responses ranging from 1 ("Not at all") to 7 ("To a great extent"). We reverse-scored the last two and averaged the four ratings (Cronbach's α = .79) so that higher scores indicate greater role integration.

Results and Discussion

Manipulation check analyses suggest that we successfully manipulated role integration. Respondents in the role integration condition reported significantly higher role integration (M = 4.78) than respondents in the segmentation condition (M = 4.00; $t(95) = 5.4$; $p < .001$).

Of far greater importance, respondents in the role integration condition reported significantly higher scores on our work-based construal level scale (M = 4.04) than did those in the segmentation condition (M = 3.59; $t(95) = 2.83$; $p < .01$), supporting Hypothesis 1.

The findings in this study provide evidence supporting our prediction that role integration shapes construal level in a setting that allows us to draw inferences about causal relationships. While we cannot discount the possibility that construal level may also shape role integration, these findings provide evidence supporting the causal direction that we hypothesized. Moreover, the fact that we were able to replicate the findings of Study 1 in a different setting and with different measures of role integration and construal level lends confidence to our interpretation of the findings in Study 1. However, while construal level provides information about workers' mental mindsets it is also important to evaluate whether these effects on cognition have organizationally-relevant downstream consequences, consistent with our overarching conceptual framework of bounded rationality. In particular, we expect that the same trade-offs and constraints that drive boundary theory and construal level theory should emerge with respect to organizationally-important choices and information search behavior. Thus, the goal of the study that follows is to evaluate the effect of construal level on exploratory learning.

STUDY 3

Study 3 manipulated construal level using a categorization task and measured distant search behavior—one of the most commonly-studied forms of exploratory learning (Gavetti et al., 2012) to test Hypothesis 2 linking construal level to exploration.

Participants

One hundred and five working adults were recruited on an online platform where people participate in studies for payment. Six participants were dropped from the analyses for failing our attention check. Thus, 99 participants (69 men, age: M = 32.3, SD = 10.92) were included in the final analyses.

Procedure

Construal level priming task. We used a prime developed by Fujita et al. (2006) to manipulate construal level by inducing more abstract or concrete mindsets. Participants were given a list of 30 items (e.g., college, actor, coin). Those in the high construal level condition were asked to generate the more abstract overarching category that each item belongs to, while those in the low construal level condition were asked to generate more concrete specific examples of each item. This prime has been used in the construal level theory literature to explore the effects of abstraction on a wide variety of attitudinal and behavioral outcomes (for a review, see Burgoon, Henderson, & Markman, 2013).

Exploratory learning behaviors. After priming participants for construal level, we assigned them an information search task. Prior organizational learning research distinguishes less exploratory "local" or "neighborhood" searches from more exploratory "global" or "distant" searches (Levinthal & March, 1993). These forms of search have been used to measure exploration (e.g., Beckman, Haunschild, & Phillips, 2004; Rosenkopf & Nerkar, 2001; Stuart & Podolny, 1996). There are few experimental studies of exploratory learning behavior (Gavetti et al., 2012; but see the "alien game" in Billinger, Stieglitz, & Schumacher, 2014 for a rare exception) and we are not aware of any experimental paradigm that simulates traditional managerial tasks and is thus appropriate for a sample of working adults. We therefore developed an information search task modeled on a vendor selection process that was actually used in a large financial services corporation. Specifically, participants were told to imagine their employer sought to outsource its telephone customer service support, and their task was to search for information about six potential vendors in order to make a recommendation.

We presented participants with an information board (Payne, 1976)—a 6 × 6 matrix with rows representing alternative vendors and columns indicating vendor attributes (call handling time, phone representative experience, phone representative yearly turnover rate, vendor years in business, cost per minute, and customer data security). Similar information boards have been used in prior

research (e.g., Biggs, Bedard, Gaber, & Linsmeier, 1985; Payne, 1976).

To differentiate local search (based on existing relationships) from distant search (developing new relationships; e.g., Beckman et al., 2004), respondents were told that two of the vendors provided service to other divisions of the company while the other four offered opportunities to create new relationships. To simulate the practical reality that search is costly, respondents were able to click on a maximum of 12 cells in the matrix. Exploratory learning behavior was measured with respect to the proportion of clicks that participants allocated to unfamiliar options, with higher scores reflecting more distant search.

Exploratory learning intentions. To ensure that our experimental paradigm captured exploratory learning behavior, we asked participants to indicate the extent to which the search decisions were motivated by exploratory learning intentions. Specifically, participants indicated: (1) "During your decision-making process, to what extent did you seek to innovate?" (2) "How willing were you to take a risk?" and (3) "To what extent did you search for new vendors?" (Responses ranged from "not at all" (1) to "to a great extent" (7).) Responses to these three items were averaged to create a scale measuring exploratory learning intentions (Cronbach's $\alpha = .81$).

Manipulation check. To ensure that the construal level prime successfully manipulated participants' mental mindsets, we asked participants to describe the search decisions they made using three items from Burrus and Roese's (2006) Rating of a Life Event measure. This measure has been validated as a measure of construal level and used to assess experimental manipulations of construal level in prior research (e.g., Burgoon et al., 2013; Burrus & Roese, 2006; Giacomantonio, De Dreu, & Mannetti, 2010; Giacomantonio, DeDreu, Shalvi, Sligte, & Leder, 2010). The items we used were: (1) Meaningless–Meaningful, (2) Not important–Important, (3) Influences minor detours in my life–Influences overall path of my life. We averaged the three ratings to obtain a construal level score (Cronbach's $\alpha = .79$) with higher scores reflecting more abstract mindsets.

Results and Discussion

Our construal level manipulation was successful; respondents in the high construal level condition reported construing their decisions at a higher level on our manipulation check scale ($M = 4.94$) than did respondents in the low construal level condition ($M = 4.41$; $t(97) = 2.9$; $p < .01$).

We also found evidence in support of our hypothesis that higher construal would lead to more exploratory learning in the form of more distant search. Respondents in the high construal level condition reported stronger exploratory learning intentions ($M = 4.64$) than respondents in the low construal level condition ($M = 3.97$; $t(97) = 2.3$; $p < .05$). Consistent with Hypothesis 2, respondents in the high construal level condition allocated a higher proportion of their clicks to unfamiliar cells (suggesting more distant search; $M = 71\%$) than respondents in the low construal level condition ($M = 58\%$; $t(97) = 2.73$; $p < .01$). To assess whether respondents' exploratory learning intentions explain the positive relationship between higher construal level and distant search, we tested for mediation using the bootstrapping method developed by Preacher and Hayes (2008) using 5,000 bootstrap resamples. Mediation is said to occur when the derived confidence interval does not contain zero. The indirect effect of construal level condition through exploratory learning intentions on search behavior was statistically different from zero (95% CI = .0088 to .1286), suggesting that exploratory learning intentions underlie the positive relationship between construal level and distant search in our study.

Study 3 provides evidence supporting the positive relationship between construal level and an important form of exploratory learning (i.e., search behavior) in an experimental setting, enabling causal inferences. Our experimental paradigm, while oversimplified, is rare in the existing literature (Billinger et al., 2014), and offers a behavioral measure of information search relevant to real-world managerial decisions. Combined with the results of Studies 1 and 2, the patterns we find suggest that role integration shapes construal level, which in turn shapes exploratory learning. However, a limitation of manipulating the hypothesized mediator is that it is not possible to explore the entire process from role integration to exploration. Also, experimental manipulations maximize internal validity but at the expense of external validity. Study 4 was designed to address these concerns.

STUDY 4

Our final study extends the prior findings by exploring how knowledge workers' role integration behaviors and their construal level relate to their

exploratory learning behavior. We examine these relationships in a field study surveying knowledge workers in three waves over a four-month period.

Respondents

We recruited a panel of knowledge workers from an online platform where people can choose to participate in surveys for payment. Five hundred adult, US-based full-time workers took a screening survey containing various questions about their work activities. In the first part of the survey, we differentiated knowledge workers from other kinds of workers by asking them: (1) to describe their work in a few sentences, and (2) to indicate the extent to which their work corresponded to a common definition of knowledge work (i.e., "knowledge work tasks include planning, analyzing, interpreting, developing, and creating products and services using information, data, or ideas as the raw materials"; Heerwagen, Kampschroer, Powell, & Loftness, 2004). In the second part of the screening survey, respondents were asked to indicate how they used mobile technology to integrate their social roles and also reported demographic information. Overall, 169 of the 500 respondents fit our knowledge work criteria and were invited to participate in the surveys at Time 2 and Time 3. Of those, 138 responded to the Time 2 survey, which took place four weeks later and assessed work-based construal level (82% response rate) and 80 of those respondents participated in the Time 3 survey, which took place 12 weeks after the second survey and included our measure of exploratory learning activities.[4] Thus, the response rate for those eligible participating in all three surveys was 47%. To assess how representative our final sample was, we compared the final sample of respondents who completed all three surveys over the 16-week period to those who responded only at Time 1, using the three demographic measures included in the screening survey: gender, age, and number of children. The final sample was not significantly different from the Time 1 sample with respect to gender or number of children. There was a small but significant difference in age, with our final sample ($M(age)$ = 36.1 years) somewhat older than the initial sample (M = 31.2 years; $t(167) = 3.051$, $p = .003$).

[4] Only four weeks elapsed between the first two survey administrations because we expect that role integration and construal level (assessed in Surveys 1 and 2 respectively) are both domain-specific and somewhat reinforcing. However, we allowed 12 weeks to elapse between Surveys 2 and 3 to increase the likelihood that the exploratory learning behaviors that were most recent and thus salient to respondents in Survey 3 were most likely to be those that temporally followed the formation of the mental mindsets reported in Survey 2.

Measures

Role integration behaviors. We measured integration across spatial role boundaries in Time 1 with four items. Specifically, we asked respondents: "Think about your work activities in a typical month. Please report how often, on average, you perform job-related tasks using mobile devices (smartphone, tablet, netbook, etc.) in the following settings": Respondents indicated the extent to which they used mobile devices to work away from traditional work contexts: (1) "At home, at your desk," (2) "At home, away from your desk (e.g., living room, bedroom, etc.)," (3) "In your company's premises, away from your work station (e.g., meeting room, other office, etc.)," and (4) "Out of your company's premises, away from your home (e.g., public transportation, client's premises, etc.)." Responses ranged from "Never" (1) to "All the time" (7), and scores on the items were averaged to form the role integration index, with higher scores indicating greater spatial role integration behavior.

Work-based construal level. Work-based construal level was assessed at Time 2 (four weeks after Time 1). To assess work-based construal level, we used the work-based construal level scale described in Study 2 (Cronbach's α = .91 in this sample). Participants were given the 18 common work activities and asked to indicate which of two descriptions—a high-level and a low-level—best described the behavior for them. Following Vallacher and Wegner's (1989) recommendation, participants' abstraction score was the sum of high-level alternatives chosen.

Exploratory learning activities. We assessed exploratory learning activities in Time 3 (16 weeks after Time 1) with a five-item scale developed by Mom, van den Bosch, and Volberda (2007; Cronbach's α = .85). Respondents were asked to indicate the extent to which they engaged in, for example, "searching for new possibilities with respect to products/services, processes or markets" or "activities requiring you to learn new skills or knowledge" (the response scale ranged from "never" (1) to "all the time" (7)).

Controls. Given that prior research and our findings in Study 1 have linked power to levels of mental representation (Smith & Trope, 2006; Smith et al., 2008), we controlled for supervisory responsibility by asking respondents to indicate if they supervised direct reports at work (Non Supervisor = 0, Supervisor = 1). We also controlled for gender (Male = 0, Female = 1), age and number of children because respondent's personal responsibilities and life stage may influence their use of technology outside of work environments. We controlled for tenure (in years) and level of education (high school or below = 0, college = 1, graduate degree = 2) which may influence exploratory learning and construal level.

Results

Table 3 displays means, correlations, and ranges for all of the measures in our study. The 80 respondents who took all three waves (56% female, 44% male) were generally college graduates (68% had at least an undergraduate degree). At the beginning of the study their average job tenure was 6.12 years and 53% were in supervisory roles. Our respondents' job functions were varied, including information technology, human resources, and administrative functions.

We conducted two hierarchical multiple regression analyses to assess the relationship between participants' role integration and each of construal level and learning activities. In the first step, we controlled for age, gender, number of children, hierarchical rank, education and tenure (see Table 4, columns 1 and 5).

Hypothesis 1 predicted that the extent to which employees engaged in role integration behaviors in Time 1 would be positively associated with construal level in Time 2. Consistent with our findings in Studies 1 and 2, the results reveal that role integration in Time 1 significantly predicts work-based construal level at Time 2.[5] Hypothesis 2 predicted that construal level (Time 2) would be positively associated with exploratory learning activities (Time 3). Regression results again support our predictions; Table 4 (column 4) reveals a significant positive relationship between construal level and exploratory learning.[6]

Hypothesis 3 predicted that employees' work-based construal level would mediate the relationship between role integration and exploratory learning. We tested for mediation using the bootstrapping method developed by Preacher and Hayes (2008) using 5,000 bootstrap resamples. The indirect effect of role integration (Time 1) through work-based construal level (Time 2) on exploratory learning (Time 3) was statistically different from zero (95% CI = .0036 to .0523), which supports Hypothesis 3. The findings reported in Table 4 (column 7) suggest that role integration remained a significant predictor of learning activity when work-based construal was included in the model, suggesting significant partial mediation.

Overall, the results in Study 4 replicate and extend the findings of Studies 1–3. Our findings suggest that role integration is associated with higher construal levels, replicating the results of Studies 1 and 2 and lending support to Hypothesis 1. Moreover, we demonstrate that work-based construal level (Time 2) is associated with greater engagement in exploratory learning activities (Time 3), replicating the results of Study 3 in a field study and thus lending additional support to Hypothesis 2. Moreover, role integration (Time 1) is positively related to exploratory learning (Time 3), and work-based construal level (Time 2) partially mediates this relationship, supporting Hypothesis 3. Study participants were a sample of knowledge workers in a variety of job functions, providing support for the generalizability of our findings to workers for whom exploratory learning is likely to be important for job effectiveness. The multi-wave study design has the benefit of reducing the likelihood of common methods bias. However, unlike the prior studies which contain manipulations or behavioral measures, a limitation of the design of Study 4 is the fact that the dependent variable in this study was self-reported.

GENERAL DISCUSSION

Using diverse methodologies and measures, we obtained convergent findings regarding the

[5] We also used the LCM method (utilized to analyze the emails in Study 1) to code the construal level of the job descriptions respondents provided in the first survey wave. We included this unobtrusive measure of construal level (Time 1) in our analyses predicting work-based construal level at Time 2. Role integration remained a significant predictor of subsequent construal level even controlling for prior construal level, supporting the causal direction we hypothesized.

[6] We tested for the relationship between construal level and exploitative learning and found no significant relationship. Also, as a robustness check we ran all analyses without the controls and our results verified that all of the key findings regarding role integration behaviors, construal level and exploratory learning were robust to the alternative model without controls both with respect to direction and level of significance.

TABLE 3
Descriptive Statistics for all Variables (Study 3)

Variables	Mean	*SD*	Min	Max	1	2	3	4	5	6	7	8	9
1. Age	36.14	11.13	19	62									
2. Gender	.562	.499	0	1	.205								
3. # of children	.512	.914	0	4	.153	.137							
4. Rank	.462	.501	0	1	.097	.060	.084						
5. Education	1.65	.530	0	2	–.051	.130	.032	–.053					
6. Tenure	6.11	2.14	1.17	14	.167	.139	–.060	–.183	.395**				
7. Role integration	3.35	1.50	1	7	–.087	–.197	–.083	.285*	.095	–.081			
8. Work-Based Construal Level	9.56	5.12	1	18	.008	–.195	.005	.085	.122	–.024	.347**		
9. Exploration	4.3	1.39	1.2	7	.038	–.353**	–.155	.099	.241*	.144	.451**	.453**	

Note: N = 80.
* $p < .05$
** $p < .01$

relationships between role integration, construal level, and exploratory learning. Our analysis suggests insights that enrich existing theory and research, open up new avenues of inquiry, and integrate disparate research streams.

Implications for Boundary Theory

Research on boundary theory has explored the challenges of managing role boundaries and role transitions and described the form and function of boundary work (e.g., Kossek et al., 1999; Kreiner, 2006; Nippert-Eng, 1996; Rothbard et al., 2005). This literature assumes that role boundaries are psychologically important but has neglected to evaluate the relationship between boundary management activities (e.g., segmentation and integration) and characteristics of workers' cognition (i.e., abstractness). We draw upon construal level theory to generate novel hypotheses regarding the

TABLE 4
Regressions of Construal Level and Learning Behaviors (Study 4)

Column/Hypothesis Dependent Variable	1 H1 Work-Based Construal Level Step 1	2 H1 Work-Based Construal Level Step 2	3 H2 Exploration Step 1	4 H2 Exploration Step 2	5 H3 Exploration Step 1	6 H3 Exploration Step 2	7 H3 Exploration Step 3
Controls							
Age	.063	.077	.128	.106	.128	.145	.123
Gender (male = 0, female = 1)	–.230	–.166	–.419**	–.337**	–.419**	–.343**	–.297**
Children	.010	.036	–.134.	–.137	–.134	–.104	–.114
Rank (non man. = 0, manager = 1)	.091	–.004	.154	.122	.154	.042	.043
Higher education (no = 0, college = 1, Graduate degree = 2)	.182	.133	.278*	.214*	.278*	.220	.184
Tenure	–.057	–.039		.111	.091	.112	.123
Main effects			.091				
Role integration	—	.309*	—	—	—	.364**	.279**
WBCL	—	—	—	.364**	—	—	.275**
Adjusted R^2	.001	.075	.209	.324	.209	.320	.381
Change in R^2	—	.074		.105	—	.111	.061

Note: N = 80. The coefficients reported in each column are standardized β coefficients.
* $p < .05$
** $p < .01$

effect of boundary management on workers' mental mindsets. Across multiple studies, we demonstrate an association between role integration and construal level, with implications for how abstractly people communicate in their professional emails and their propensity to engage in exploratory learning.

The idea that role integration and segmentation behaviors may shape workers' mental representations is important for several reasons. First, it suggests novel consequences of boundary management that extend those considered in prior research. Much of the focus in prior research is on the effect of role integration and segmentation for outcomes such as stress, job satisfaction, and well-being (e.g., Edwards & Rothbard, 1999; Kossek et al., 2006; Kreiner, 2006). These consequences are important from the perspective of the role occupant, and may have downstream implications for workgroups, families, and work performance. Complementing this work, our exploration of the effect of role boundaries on workers' mental representations suggests that there may also be cognitive implications of role integration, such as the types of alternatives workers consider and the decisions they make. These outcomes have important strategic and organizational implications, and thus expand the scope of boundary theory research. Our findings suggest new questions; for example, role integration behaviors may influence organizationally important outcomes such as innovation, which itself is related to exploratory learning.

Second, our perspective potentially offers a more elaborated understanding of the boundary management process itself. For example, an important conclusion from prior boundary theory research is that transitions between roles are facilitated by role integration (e.g., Ashforth et al., 2000), but as yet we know little about the underlying psychological processes involved in these transitions. Perhaps such role transitions are enabled by more abstract mental representations. Abstract mental representations associated with higher construals enable comparisons of diverse targets and the transfer of knowledge and experience outside its original context, which may be critical to satisfying competing role demands simultaneously. Likewise, the focus and execution orientation associated with more concrete mental representations, which we suggest may be facilitated by erecting and maintaining thicker role boundaries, might be responsible for some of the benefits of role segmentation described in prior work (e.g., Perlow, 1999). These cognitive processes may relate to the social interactions and social negotiation of boundaries that have been explored in prior research on role transitions (e.g., Kreiner et al., 2009).

Novel costs and benefits of role integration may also be suggested by our analysis. For example, while higher construal makes strategic goals more salient, people operate more efficiently and act more expeditiously when their construals are lower and their mental representations are therefore more concrete. Thus, the costs may outweigh the benefits of role integration when the demands of a specific role require complete and focused attention. When attentional requirements are very high (perhaps the case for Perlow's (1999) software engineers), role integration may be ineffective for such workers at the same time that it may be helpful to other knowledge workers whose tasks demand less focused attention (and perhaps more exploratory learning behavior). Future research may identify when workers can operate at a higher level of construal, mentally representing their roles more abstractly, without sacrificing job performance.

Our exploration of the relationship between role integration behaviors and construal level is domain-specific. However, both conceptually and methodologically, we focus on the cumulative effects of role integration behaviors over time within role. This leaves open the possibility that engaging in role integration *in the moment* may have a different effect on cognition (perhaps even leading people to think more concretely) than the cumulative effects of role integration behaviors that we explored. Future research may take a more dynamic perspective than we have assumed here, evaluating whether momentary effects of role integration on cognition and other outcomes may differ from the cumulative effects we study.

Mobile technologies are only one factor that may increase role integration behaviors, but our investigations of the cognitive and behavioral consequences of role integration often makes mobile technology salient because we believe these technologies to be an important enabler of role integration, especially for knowledge workers. In this respect, our work is relevant to research on telework, which has focused primarily on individual-level outcomes of technology-enabled work modes, including worker satisfaction, commitment, and work–life conflict (Gajendran & Harrison, 2007). If teleworkers engage in mobile technology-enabled role integration, then our findings suggest that telework may be associated with a host of previously-unexplored organizationally-relevant outcomes such as exploratory learning behavior. However, given the likely salience of mobile technology in our studies, an important question for future research

may be whether mobile technology-enabled role integration is a boundary condition for our findings or whether our model might also apply to role integration enabled via other means, such as multicultural experience. For example, it is possible that so-called "cosmopolitans" who live and work in multiple countries may engage in higher levels of role integration (and have higher construal level) than "locals" whose experience is more confined (Haas, 2006).

Another boundary condition for our model is that we focused on micro-role transitions (work/non-work and at-work transitions) but not macro-role transitions such as those involved in graduation, retirement, or job loss. Future research may explore whether the nature of the roles being integrated, or the nature of the transition required between roles (e.g., role integration that is experienced as threatening and stressful rather than challenging and energizing), may moderate the effect of role integration on construal level and learning behavior. Workers' role integration preferences may play an important role, as well; it is possible that feeling forced to integrate when role integration is not one's preference would attenuate the relationship between role integration and higher construal level.

Also, our findings regarding the effects of role integration on construal level are similar for integration across temporal (Study 1) and spatial (Study 4) role boundaries. Future research may fruitfully explore whether role integration has different effects on cognition depending upon whether time, space, or social role boundaries are bridged.

Implications for Construal Level Theory

Our findings extend construal level research, which has generally been applied to targets such as events and objects that are clearly delineated in time and space. In traditional conceptualizations of construal level theory, objective distance from a target yields psychological distance and thus impacts mental representations. However, it is not clear how objective distance applies to targets that are less tangible (and thus less easily bounded in time and space). We extend notions of psychological distance to apply to the social roles people enact (i.e., employees' work role) by drawing upon the temporal, spatial, and social demarcations between roles described in boundary theory. People experience micro-role transitions (whether work/non-work or at-work) throughout the day (Ashforth et al., 2000). We suggest that people who behaviorally segment their work roles may conceptualize their work at a low level of abstraction because each work activity requires specific contextual information (i.e., locations, timeframes, etc.) to be performed. Conversely, we suggest that people who behaviorally integrate their work roles may conceptualize their work at a high level as a functional adaptation to cognitive limitations and the challenges of role interruptions, overlaps, contamination, and conflicts. Thus, construal level may be domain-specific.

By linking construal level theory to work roles, we not only extend construal level research beyond the objects and events studied earlier but we also open up new avenues of inquiry regarding the possible implications of more abstract or concrete mental mindsets at work. Mental abstraction may influence a host of decisions relevant to the field of organizational behavior, including motivation, time allocation, and what information is sought or used in decision-making. Our results in Study 1 suggest that construal level may be manifested in employees' communication, and thus there may be novel social effects of construal level in organizations that have not yet been considered. For example, a manager's construal level may shape how they frame a subordinate's task (more abstractly and perhaps more empowering but also more ambiguous, or more concretely but perhaps in a way that is perceived as micro-managing). Task framing may, in turn, have consequences for how subordinates execute the task.

Implications for Organizational Learning Research

Our findings may also have implications for research on exploratory learning. Prior research suggests that exploratory learning involves cognition more extensively than exploitative learning and experience-based search does (Gavetti & Levinthal, 2000). Our research may be a first step toward opening up the black box of cognition related to learning by suggesting that the type of cognition may also vary, from more abstract to more concrete. Our findings suggest that more abstract mental mindsets have important implications for distant search, or individuals' tendency to depart from the familiar, which is one of the most important ways that learning relates to innovation (Gavetti et al., 2012). We also find that role integration behaviors are positively associated with exploratory learning (Study 4). This parallels prior research on collectives suggesting that internal variety combined with integration mechanisms enhance exploration (e.g., Alexiev et al., 2010; Jansen et al., 2009; Reagans & Zuckerman, 2001;

Schilling et al., 2003; Taylor & Greve, 2006) and evidence that having "cosmopolitans" on a team who take a broader perspective enhance external knowledge acquisition (Haas, 2006). Our findings contribute by extending this to the individual level of analysis, where role integration may improve the accessibility and integration of multiple perspectives. Our findings also suggest a cognitive mechanism potentially underlying this effect (i.e., construal level or mental abstraction).

Moreover, our studies suggest methodological approaches to studying these constructs that have not been used in prior organizational research. For example, our various studies adapt or develop means of measuring and manipulating individuals' mental mindsets. These include coding their communication (Study 1), developing a domain-specific work-based construal level measure (Studies 2 and 4), and using a manipulation of construal level in which people are prompted to focus on either categories (more abstract) or exemplars (more concrete; Study 3). We also develop an exercise (Study 3) enabling the measurement of distant search that is relevant to managerial decision-making and thus more appropriate for use with working adult participants than the games used in prior work (e.g., Billinger et al., 2014). The present studies may thus facilitate subsequent research by expanding the methodological options available to scholars interested in these constructs.

Organizational Implications

The present research also has a number of important implications for management and for organizations. As organizations become more complex and global, and demands on workers increase, role integration has become more expected and practiced. Our findings suggest that role integration behaviors are a proximal factor shaping construal level. Some of what predicts role integration behaviors is organizational and perhaps may be influenced by managers. For example, because roles are inherently social, local norms, goals and incentives, the demands of interaction partners and the nature of work responsibilities are all likely to define role integration. At a minimum, managers must understand how these factors influence employees' mental representations and behavior, but perhaps this knowledge may help managers proactively shape work contexts to elicit the most appropriate and beneficial cognitions and behaviors. For example, role integration may be encouraged—and perhaps facilitated by providing appropriate technology—for employees who would perform their work better when thinking abstractly (such as those expected to engage in exploratory learning). On the other hand, managers may need to buffer employees from role integration pressure, technologically or otherwise, when effectiveness depends on narrow focus, detail-orientation, and execution, and when the costs of integration (e.g., stress) outweigh its benefits. Perhaps ubiquitous "bring your own device" policies (Cisco, 2013) may be reconsidered for such employees because these policies may enable too much role integration for some. Future boundary theory research may help managers develop the tools for assessing and monitoring their employees' level of role integration and evaluate how managers can buffer their employees from role integration pressure or otherwise influence role integration behaviors.

Exploratory learning is important to organizations because it is a promising means of enabling adaptation, particularly in dynamic contexts (March, 1991). The present findings suggest that construal level is a proximal predictor of employees' exploratory learning behavior, suggesting that managers and organizations may benefit from efforts to promote particular mental mindsets among knowledge workers who are responsible for organizational learning activities. Construal level research suggests that mobile technology and role integration pressure may be part of a larger set of tools through which organizations can influence their employees' mental mindsets. For example, existing construal level research suggests that longer time horizons create psychological distance, which in turn is associated with higher construals (Trope & Liberman, 2003). Thus, managers may be able to frame tasks and decisions with longer or shorter time horizons to help shape employees' construal level. Reward systems also focus attention and may therefore shape whether employees represent their actions more abstractly or more concretely. For example, incentives and controls that focus on process might encourage employees to focus on *how* they execute their role while those focused on outcomes may draw more employee attention to *why*.

The findings in Study 1 concerning the email communications of executives at Enron suggest that managers themselves may be impacted by role integration behaviors. Specifically, executives engaging in greater temporal role integration communicated more abstractly. This raises the possibility of coordination problems, such as when these executives' subordinates or other social interaction partners require more concrete communication. It is not clear whether integrators' more abstract communication was intentional or

unintentional—research on multi-tasking suggests that people are relatively unaware of, and overly optimistic about, the performance effects of multi-tasking. It is possible that people are likewise unaware of the cognitive and behavioral effects of role integration, and can become better managers of themselves and others through such knowledge.

CONCLUSION

Work roles and organizational life are transforming in ways that are both costly and beneficial. This process is facilitated by mobile technologies that are pervasive and evolving rapidly. The present findings draw attention to how role integration behaviors shape mental mindsets—and knowledge workers' construal level in particular—with important implications for the learning activities they engage in. This research is thus a first step in understanding the psychological processes underlying role integration behaviors, the cognitive basis of exploration, and the application of construal level to roles and to the field of organizational behavior.

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Jean-Nicolas Reyt (jean-nicolas.reyt@mcgill.ca) is an assistant professor of organizational behavior at McGill University's Desautels Faculty of Management. He received his PhD in management jointly from Paris-Dauphine University and the University of Luxembourg. His research is focused on understanding the relationship between employees' mental representations of their work and important work outcomes including creativity, exploratory learning, and interpersonal influence. He also studies mobile technology-facilitated work and other organizational factors that influence mental representations.

Batia M. Wiesenfeld (bwiesenf@stern.nyu.edu) is the Andre J.L. Koo Professor of Management at the Stern School of Business, New York University. She received her PhD from Columbia Business School. Her research interests include justice, identity, construal level, and social regard, particularly in relation to ambiguous and changing organizational contexts such as virtual work, layoffs, failure events, and emergent online communities.

APPENDIX 1

WORK-BASED CONSTRUAL LEVEL SCALE

High and low-level activity descriptions are opposite anchors of six-point scales.

Instructions: *Imagine yourself performing the following work activities, and indicate on the continuum (the verbal descriptions represent endpoints) the description that best describes each activity for you:*

DISCRIMINANT VALIDITY

We explored the correlations between our work-based construal level measure and constructs in the nomological network related to it. We contacted 1,000 participants in an online subject pool where people participate in surveys for payment. Two hundred and ninety three people (29.3% of our sample) were classified as knowledge workers following the method described in Studies 2 and

Work Activity	Low-Level Description	High Level Description
Preparing a report *	Compiling information	Showing progress
Using a computer	Typing on a keyboard	Processing information
Filling out a business form *	Filling in blanks with information	Following work protocol
Obtaining information from someone	Asking relevant questions	Gaining knowledge
Making a presentation *	Presenting relevant material	Communicating knowledge
Assigning work to someone	Telling someone what to do	Getting things done
Communicating information to someone	Sending an email or talking to someone	Keeping someone informed
Analyzing a dataset *	Comparing numbers	Identifying trends
Attending a meeting	Being present and paying attention	Staying up to date
Developing a procedure *	Writing down step-by-step instructions	Increasing work efficiency
Writing business correspondence *	Composing an email	Maintaining a good business relationship
Hiring someone	Interviewing candidates	Maintaining staff level
Developing a budget	Listing expenses and revenues	Managing funds
Proofreading a document *	Reading carefully for errors	Ensuring accuracy
Training someone *	Showing someone how to do things	Increasing someone's productivity
Analyzing an operational report	Reviewing information	Ensuring smooth operation
Orienting a new worker *	Showing a new worker around	Acclimating a new worker
Evaluating someone's performance	Reviewing quality of work	Providing feedback

Note: "*" designates reverse-scored items.

4. We invited the selected knowledge workers to participate in our study and obtained answers from 223 of them (76% response rate). Five participants were dropped from the analyses for failing our attention check. Thus, 218 participants were included in the final analyses.

As reported in the table below, all of the correlations were significant but modest except the "Career" subscale. Thus, we conclude that work-based construal can be distinguished from other potentially related constructs.

Measures	Source	Cronbach's α	Correlation with WBCL
WBCL	N/A	.902	N/A
Job self efficacy	Chen et al. (2004)	.900	.185*
Role ambiguity	Rizzo et al. (1970).	.889	.186*
Org. identification	Mael & Ashforth (1992)	.888	.191*
Job satisfaction	Wanous et al. (1997)	N/A	.227*
Job/calling	Wrzesniewski et al. (1997)	. 696	.244*
Career	Wrzesniewski et al. (1997)	.693	.098–

Note: WBCL = Work Based Construal Level Measure.
* $p < .01$