Unlocking knowledge transfer potential:

Knowledge demonstrability and superordinate social identity

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Abstract

This study presents a conceptual model of when and how knowledge demonstrability and superordinate social identity impact the likelihood that organizations capitalize on their knowledge resources. To test the model, an experimental methodology was used in which a member transfers from one group to another, transmitting knowledge in the form of a production routine. As predicted, work groups unlocked the knowledge transfer potential arising from personnel movement more often when they shared a superordinate identity than when they did not share such an identity, and this identity effect was moderated by knowledge demonstrability. When knowledge was less demonstrable with concealed merits, it was more likely to transfer between groups that shared a superordinate identity, compared to groups that did not share such an identity. By contrast, when knowledge was more demonstrable with apparent merits, it was as likely to transfer between groups that shared a superordinate identity compared to groups that did not share such an identity. As predicted, superordinate identity induced knowledge consideration, the focusing of group attention on determining the value of another's knowledge. Mediated moderation analyses revealed that this process underlies knowledge transfer. Superordinate social identity induced thorough knowledge consideration, which was more important for recognizing the value of knowledge when its merits were concealed rather than apparent. Because the merits of many organizational routines and practices are concealed and superordinate identity appears to be a key to unlocking the knowledge transfer potential of less demonstrable knowledge, this study has important implications for managing knowledge resources.

Keywords: Superordinate social identity, knowledge demonstrability, knowledge transfer, group learning, organizational learning, mindfulness, routines

"If Hewlett-Packard knew what Hewlett-Packard knows, we would be three times as profitable"
–Lew Platt, CEO, Hewlett-Packard (Davenport and Prusak 1998, p. xxi)

Knowledge is an important organizational resource for it fuels productivity, growth, and survival. Organizations whose units learn from one another's experience are more productive, competitive, and more likely to survive than their counterparts less adept at knowledge transfer (Argote 1999). Firms spanning manufacturing to knowledge-intensive industries are able to improve their outcomes when their units skip unnecessary steps by adopting superior routines, practices, and ideas developed elsewhere in the firm (e.g., Argote, 1999; Bresman in press). Consequently, knowledge transfer is recognized as a key generator of an organization's competitive advantage (Argote and Ingram 2000). However, organizations do not necessarily realize the generally positive impact of knowledge transfer. An investigation of over one hundred efforts to transfer best practices between business units in multi-national corporations revealed numerous failed attempts (Szulanski 1996). Despite these challenges, knowledge transfer occurs in many firms, resulting in organizational learning (Argote 1999; Levitt and March 1988). Research has begun to examine factors contributing to this variation in knowledge transfer, which can be attributed to characteristics of the knowledge and characteristics of the units (Argote et al. 2003).

Scholars and practitioners have identified the availability of knowledge as a facilitator of knowledge transfer (e.g., Argote 1999; Davenport and Prusak 1998). Consequently, many organizations have implemented practices to increase knowledge availability. For example, employees are moved between units to share routines developed in their original unit with their new unit (Maritan and Brush 2003). As a result of this increased availability of knowledge, units are exposed to a myriad of useful ideas, routines, and practices. Still, organizations often fail to realize the potential of their knowledge resources. A study of eight manufacturing firms found that fewer than three quarters of their units adopted superior routines and technologies made available to them by another unit in their firm (Galbraith 1990). As Lew Platt of Hewlett-Packard notes, an organization may have knowledge within its boundaries, but it cannot fully benefit from this resource unless the units that would benefit from the knowledge implement it. Thus, the availability of knowledge, while critical, does not necessarily result in knowledge transfer.

Hindrances to knowledge transfer may not originate with source units hoarding knowledge, but instead stem from issues on the recipient side of knowledge transfer. For example, at Kodak one group developed a superior production routine, but the groups that could have benefited from this knowledge failed to implement it despite its value and availability in their own organization (Leonard-Barton, 1988). Useful organizational ideas, routines, and practices may be available, but units will not implement them unless they recognize their value. The combination of an ever-increasing amount of available knowledge and an increasingly taxed workforce exacerbates the risk of overlooking knowledge that is useful and available but requires extra attention to recognize its value. In other words, knowledge transfer will be hindered by a unit's failure to recognize the value of another's knowledge, which could arise because of its concealed merits as well as reluctance on the part of recipient units to focus their attention on another's knowledge. Thus, it is critical to understand when knowledge reveals its merits and when units will consider knowledge thoroughly enough to recognize those merits. This paper aims to gain a deeper understanding of knowledge transfer by advancing a knowledge characteristic related to the transparency of its merits, and by examining a characteristic of the relationship between units likely to impact the extent that units consider another's knowledge.

A knowledge characteristic likely to impact knowledge transfer is the extent to which its merits are recognizable, which will be referred to as "knowledge demonstrability." Highly demonstrable knowledge with apparent merits requires little consideration in order to recognize its value, whereas less demonstrable knowledge with concealed merits requires thorough consideration to recognize its value. In other words, it is not the concealed knowledge, but the knowledge whose merits jump out that is likely to be recognized and adopted. For example, the medical practice of using a Superglue-based adhesive to close topical wounds and incisions (Schilling 2008) likely transferred across surgical teams in medical organizations due to its recognizable merits. Few organizational ideas, routines, and practices, however, fall on the highest end of the knowledge demonstrability continuum with wholly transparent merits. Because organizational units rarely encounter a clear approach or solution to their tasks, most knowledge is lower in demonstrability and requires more thorough consideration to recognize its merits. This is true

for units that produce knowledge (e.g., consultants, developers, researchers) as well as for units that use knowledge to produce goods and deliver services. Thus, the transfer of most knowledge is likely to be hindered by its low demonstrability, resulting in negative organizational consequences.

A superordinate social identity is a characteristic of the relationship between units likely to facilitate knowledge transfer by promoting thorough consideration of another's knowledge. Social identity is a part of people's identity gained from a perception of belonging to social groups that impacts attitudes and behaviors (Tajfel and Turner 1979). Notably, people tend to treat their groups more favorably than other groups. This own group favoritism need not be limited to small groups, such as one's work group or team; identification with a superordinate group, such as a department or an organization, expands favoritism to an overarching collective (Gaertner and Dovidio 2000). The favorable treatment afforded to those joined together by a psychological sense of belonging to an overarching "us" is expected to extend to the allocation of cognitive resources, such as attention. This suggests that employees who view their unit and another unit as belonging to a superordinate group may consider the other unit's knowledge thoroughly enough to recognize its merits. By contrast, employees who view another unit as a separate group may consider the knowledge only cursorily. To the extent that members need to consider knowledge to recognize its merits, recipient units are more likely to adopt knowledge made available by units belonging to their overarching group. In sum, superordinate identity is expected to impact the extent that units consider knowledge, which should, in turn, promote knowledge transfer.

This research is applicable to a broad range of organizations, from those that leverage work groups to produce knowledge to those that rely on work groups to utilize knowledge to produce goods and deliver services. Although these organizations span industries as diverse as automotives (Argote 1999), consulting (Hansen and Haas 2001), fast food (Darr et al. 1995), information technologies (Cummings 2004), medicine (Reagans et al. 2005), and pharmaceuticals (Bresman in press), each has knowledge that needs to transfer from one group to another in order for the organization to thrive. Enabled by technological advances in information, communication, and transportation, managers

frequently move employees between groups to respond to the dynamic and often unpredictable flow of organizational tasks. Consequently, employees in contemporary organizations increasingly work with multiple groups (Mortensen et al. 2007). Although personnel movement can create disruptions and challenges (Lewis et al. 2007), it can also enable knowledge transfer to the extent that recipient groups incorporate the routines, practices, and ideas their newest members gleaned from working with previous groups. Research investigating the conditions under which, and processes through which, groups capitalize on the potential for knowledge transfer arising from dynamic group membership is likely to be directly applicable to addressing the challenges faced by the many organizations whose performance depends on the effective management of their knowledge resources.

In the following sections, a conceptual model of knowledge transfer is presented in order to explicate *when* and *how* knowledge demonstrability and superordinate social identity affect knowledge transfer. In particular, hypotheses are developed regarding the impact of knowledge demonstrability and superordinate identity on knowledge transfer and the process underlying these effects. Next is a review of the experimental methodology used to test the hypotheses, which capitalizes on a key advantage of a laboratory setting— the ability to examine processes underlying causal relationships while controlling for other factors, such as the availability and quality of knowledge. Finally, results and their implications are presented and suggestions for future research directions are offered.

Conceptual Model and Hypotheses

Scholars from multiple disciplines, including organization behavior and theory, psychology, and strategic management, have set out to understand knowledge transfer, which occurs when the experience of one organizational unit affects another (Argote and Ingram 2000). Reviews of this research highlight a growing understanding of factors impacting knowledge transfer as well as gaps in understanding (Argote 2005; Argote et al. 2003; Argote 1999). For example, research has shown that personnel movement can be a powerful mechanism for transferring knowledge because individuals can share tacit as well as codifiable knowledge (e.g., Almeida and Kogut 1999; Choi and Levine 2004). In particular, observational field studies highlight the prevalence of personnel movement and its association with

knowledge transfer (Dokko et al. in press; Galbraith 1990; Maritan and Brush 2003), and experimental behavioral studies reveal a causal relationship between personnel movement and knowledge transfer that is contingent on other factors, such as knowledge quality (Kane et al. 2005). The emerging conceptual framework organizes factors that impact knowledge transfer into characteristics of knowledge, units, and the relationship between units (Argote et al. 2003). As a result, quite a bit is known about *when* knowledge transfer is likely to occur. Comparatively less is known about *how* these factors promote or impede knowledge transfer (Argote 1999; Zellmer-Bruhn 2003). For example, a psychological characteristic of the relationship between units (i.e., superordinate identity) was found to promote knowledge transfer (Kane et al. 2005), but the process underlying this effect is not yet well understood. Along related lines, little attention has been paid to factors impacting the process through which a unit determines the value of another's knowledge (c.f., Menon and Blount 2003; Todorova and Durisin 2007). This lack of attention to underlying process hinders theoretical progress, as such an understanding is critical to systematically explain variations in phenomena (Sutton and Staw 1995). Consequently, scholars (e.g., Argote 2005; Argote et al. 2003; Zellmer-Bruhn 2003) have called for a deeper examination of the conditions under which, and especially the processes through which, knowledge transfer occurs.

The current paper offers and tests a conceptual model of *when* and *how* two organizationally relevant and theoretically important factors, knowledge demonstrability and superordinate social identity, impact knowledge transfer. The model draws on previous research and theory in assuming the following: (a) knowledge is embedded in collective routines (Levitt and March 1988; Zellmer-Bruhn 2003); (b) personnel movement exposes one unit to another unit's superior routine (Argote and Ingram 2000; Kane et al. 2005); (c) units are work groups, an increasingly prevalent organizational form ("Occupational Outlook," 2008-2009) critical to organizational learning (Argote 1999; Edmondson 2002); and (d) knowledge transfer occurs when one group adopts another group's routine (Argote and Ingram 2000). Knowledge transfer is expected to occur more often when knowledge is high in demonstrability and when groups share a superordinate social identity. Few, if any, organizational routines or practices are so high

in knowledge demonstrability that their merits jump out, requiring no consideration. Thus, the model posits that "knowledge consideration," the focusing of recipient group attention on determining the value of another's knowledge, is an important process underlying knowledge transfer. In doing so, the model draws attention to the often overlooked, but critical, recipient side of knowledge transfer. In sum, this research aims to contribute a deeper understanding of knowledge transfer by presenting a model of conditions under which, and processes through which, knowledge transfer occurs.

A Property of the Knowledge - Knowledge Demonstrability

Properties of knowledge affect the extent to which it transfers (Argote et al. 2003). For example, a source group's knowledge transfers more frequently to a recipient group when it is superior to the recipient group's knowledge (Kane et al. 2005). Quality, while important, is not the sole knowledge property that impacts knowledge transfer. Codifiability and tacitness are also important knowledge properties that affect the ability to convey and receive knowledge (Martin and Salomon 2003; Zander and Kogut 1995). A related property is causal ambiguity or uncertainty about which features of knowledge render it useful (Szulanski 1996). Yet, before these properties impact knowledge transfer, a recipient group must recognize merit in a source group's knowledge. This involves a subjective valuation of the knowledge because, prior to adoption, the usefulness of knowledge can only be estimated (Menon and Blount 2003). To examine a property associated with this valuation, the current conceptual model holds the objective quality of knowledge constant at a high level while varying the level of knowledge demonstrability.

Knowledge demonstrability, the extent that the merits of knowledge are recognizable, is a significant knowledge property from both a theoretical and a practical perspective. Theories that stress knowledge properties associated with the ease and speed of knowledge transfer (e.g., Szulanski 1996; Zander and Kogut 1995) assume that recipients recognize the merits of knowledge. This assumption likely stems from methodologies that rely on retrospective data from critical incidents of knowledge transfer (e.g., best practice, innovations) whose merits have been previously recognized. Practically, however, organizations and their members are faced with the critical task of recognizing the merits of knowledge. Organizational examples suggest that doing so can be both difficult and highly

consequential. For example, in the case of Cadbury, observers attributed a decrement in market share to the company not recognizing the merits of knowledge embedded in a single-line production routine used by Mars Corporation (Child and Smith 1987). Along related lines, recognizing the value of knowledge is an important and under-researched component of firm absorptive capacity (Todorova and Durisin 2007). This suggests that knowledge properties associated with recognizing its value, such as knowledge demonstrability, be included in theories of knowledge transfer.

The current model derives knowledge demonstrability from a theory of task demonstrability in group research. Laughlin (1980) proposed a task continuum, anchored by judgmental tasks on one end and intellective tasks on the other. At the intellective end of the continuum, a conceptual system with rules, operations, and relationships provides an assessment criterion for demonstrating a correct solution. Laughlin and Ellis (1986) advanced the following conditions that, when met, render the solution to a task more demonstrable: (a) group members share a conceptual system, (b) group members accept that the task is solvable within the conceptual system, (c) group members have sufficient knowledge of the conceptual system to recognize the solution when it is proposed, and (d) knowledgeable members are able to demonstrate the solution. Empirical inquiry confirms that as task demonstrability increases, the likelihood that a group response reflects the expertise or solution of its more accurate members also increases (Bonner et al. 2002; Laughlin et al. 1999; Laughlin and Ellis 1986). Furthermore, on highly demonstrable tasks, groups have been found to adopt a proposed solution even when only one member advocates it (e.g., Laughlin and Ellis 1986). As Bonner et al. (2004) point out, the merits of highly demonstrable solutions are transparent, whereas the merits of less demonstrable solutions are not.

The merits of highly demonstrable knowledge are more easily recognized than the merits of less demonstrable knowledge, because such recognition requires fewer inferences and cognitive steps. One determinant of the number of inferences required to recognize the merits of knowledge is the specific form in which the merits are presented (Larkin and Simon 1987). Some presentations of knowledge obscure its merits, whereas others illuminate them. When knowledge is highly demonstrable, the cognitive processes required to recognize its merits are so efficient that they can be described as

perceptual 'seeing.' By contrast, recognizing that less demonstrable knowledge satisfies an assessment criterion involves more inferences and steps than recognizing that more demonstrable knowledge satisfies the same criterion. In summary, increases in demonstrability decrease cognitive processing load, requiring less thorough knowledge consideration in order to recognize its merits.

Some knowledge is likely to be more demonstrable than other knowledge of comparable objective quality. For example, consider two medical practices whose transfer has been documented. The first practice requires that health care providers apply a Superglue-based tissue adhesive to close topical incisions. The merits of this practice (e.g., quick, painless, and no need for subsequent removal of foreign objects, such as sutures or stitches) are readily apparent. Data suggest that healthcare providers have readily adopted this highly demonstrable practice (Schilling 2008). The second practice requires that health care providers wash their hands before treating patients. The merits of this practice (e.g., reduced spread of bacterial germs) are not as readily apparent. A greater number of inferences are needed to recognize that better patient outcomes would result from eradicating invisible microorganisms carried on one's seemingly innocent hands. Although many studies reveal that healthcare workers have frequently failed to adopt this less demonstrable practice, an intervention that increased the demonstrability of the practice by making visible the bacteria on healthcare providers' hands resulted in increased adoption (Dubner and Levitt 2006). A plausible interpretation of this knowledge transfer variation may have to do with less demonstrable knowledge requiring more thorough consideration in order to recognize its merits.

Thus, the demonstrability of knowledge is likely to impact whether recipients readily recognize its merits and, based on that assessment, whether they adopt the knowledge. Taken together, this theory and evidence suggest the following direct effect of knowledge demonstrability on knowledge transfer.

HYPOTHESIS 1. *More demonstrable knowledge will be more likely to transfer than will less demonstrable knowledge.*

A Property of the Relationship between Groups - Superordinate Social Identity

Organizational learning and knowledge management literatures have begun to appreciate the importance of the relationship between units (e.g., a source and a recipient) to knowledge transfer (Argote

et al. 2003). Past field work indicated that knowledge transfer was more likely when source and recipient were part of a superordinate group, such as a kibbutzim federation (Ingram and Simons 2002) or a fast-food franchise (Darr et al. 1995), than when they were not. Subsequently, researchers reasoned that being part of a superordinate group facilitated knowledge transfer when it created a superordinate social identity, a sense of belonging to an overarching group (Kane et al. 2005). Results of their experimental behavioral study revealed a causal relationship between superordinate identity and knowledge transfer, while ruling out alternative factors that may have accounted for the field evidence (e.g., standardization, knowledge relevance, and language similarity). Further, the relationship was predicted and found to be stronger when the source group's knowledge was superior rather than inferior to the recipient group's knowledge. This work did not, however, address the process through which superordinate identity impacts knowledge transfer, which is addressed in the current conceptual model.

Social identity theory (Tajfel and Turner 1979) proposes that people gain social identity, a part of their identity, from the groups to which they perceive themselves as belonging. Capable of contributing to a positive sense of self and helping people understand the social world and their place in it, social identity develops when membership in a group either matches relevant features of reality or is subjectively important. Consequently, situational features that highlight a group, such as a collective name, symbol, purpose, and fate, tend to increase the salience of membership in, and identification with, a group (e.g., Ellemers et al. 1999; Gaertner and Dovidio 2000; Kramer and Brewer 1984). Contemporary management practices, such as hot desking, geographically-distributed work, collective performance evaluations and bonuses, and symbolic management, highlight employees' membership in higher-order units (e.g., a cross-functional or geographically-distributed unit, department, division, or organization) and contribute to the development of social identity from these organizational units that encompass lower-order units (Ashforth and Johnson 2001; Hinds and Mortensen 2005; Millward et al. 2007; Sethi 2000). Referred to as superordinate social identity, this shared identity is a psychological state derived from employees' sense of belonging to a higher-order group. Regardless of the size of the collective from which social identity is derived, there is substantial evidence of ingroup favoritism in attitudes and

behaviors ranging from interpersonal evaluations to reward allocations and cooperation (Brewer 1979; Dovidio et al. 2006; Hewstone et al. 2002; Tyler and Blader 2003). Supportive of the common ingroup identity model that underscores the promise of extending ingroup favoritism across overarching collectives (Gaertner and Dovidio 2000), evidence is amassing that when members share a superordinate identity they engage in behaviors supportive of the higher-order group, such as communicating across distance to resolve conflicts (Hinds and Mortensen 2005), helping others to complete tasks (Dovidio et al. 1997), adopting another's knowledge to improve productivity (Kane et al. 2005), and contributing to the creation of cross-functional products (Sethi 2000).

An important goal of the current research is to understand the process through which superordinate social identity impacts knowledge transfer. One explanation is that it functions in a manner analogous to a mechanical switch, such that a superordinate identity opens the pathway for knowledge to transfer from a source to a recipient group. If this were the case, knowledge shared by ingroup sources would be automatically adopted by recipients, whereas knowledge shared by outgroup sources would be automatically rejected by recipients. This explanation assumes recipients rely on a source characteristic (e.g., social identity) to the exclusion of knowledge characteristics (e.g., demonstrability, quality) when deciding whether to adopt knowledge. Along these lines, some research has found evidence that a source's social identity has a direct impact on adoption that is independent of the content of the message (Abrams et al., 1990; Foreman et al. 2008). Decades of psychological research on attitude change highlight a similar process in which source characteristics (e.g., expertise) serve as a short cut upon which people rely when they lack the motivation to systematically process information (for reviews, see Petty and Wegner 1998). In other words, when motivated to expend cognitive resources, people thoroughly process information, limiting their reliance on short cuts. Consequently, this explanation rests on recipients' lack of motivation to consider knowledge and implies that superordinate identity will have a direct impact on knowledge transfer, independent of knowledge characteristics.

The explanation advanced in this conceptual model is a mindful one that highlights the impact of superordinate social identity in motivating knowledge consideration, the focusing of attention on

determining the value of another's knowledge. Recipient groups are expected to allocate more cognitive resources to consider knowledge from groups with whom they share a superordinate social identity than from groups with whom they do not share such an identity. If this is the case, knowledge shared by ingroup sources will be thoroughly considered, whereas knowledge shared by outgroup sources will be cursorily considered. As a result, recipients will be more likely to recognize the merits of a source's routine and adopt that knowledge when they share a superordinate identity than when they do not share such an identity. Evidence to support this explanation can be found in studies of individuals' propensity to change their attitudes. Cognitive processes, such as knowledge consideration, can be measured using information-processing techniques, such as counting thoughts in verbal reports (Ericsson and Simon 1980). Using related techniques, researchers found that targets generated more thoughts about a source's persuasive message when they shared a social identity with the source than when they did not (Van Knippenberg 1999). Corroboratory indirect evidence can be found in adoption patterns that reflect message characteristics, such as quality (Mackie et al. 1992; Mackie et al. 1990, study 1; Van Knippenberg 1999). Targets who shared a social identity with a source were found to be more likely to adopt attitudes consistent with high than with low quality messages. By contrast, those who did not share a social identity with a source were found to be unlikely to adopt attitudes consistent with persuasive messages, regardless of their quality. In sum, this explanation advances superordinate identity as a motivator of knowledge consideration and implies that superordinate identity will have an impact on knowledge transfer that is contingent on knowledge characteristics, such as demonstrability.

Why, though, would sharing a superordinate identity motivate groups to consider another's knowledge? Knowledge consideration can be viewed as an exploratory learning process, because cognitive resources are allocated to knowledge whose value is uncertain. Although the benefits of attending to new knowledge may not outweigh the costs of diverting attention from exploiting existing knowledge, exploratory learning is critical to long-term adaptation (March 1991). The propensity of a group to incur this strategic risk and consider another group's knowledge should be associated with its perceived benefits, which are likely to vary as a function of superordinate identity. Sharing a social

identity with a source is expected to highlight the promise of engaging in knowledge consideration, because it creates an expectation that the knowledge has merits and a psychological motive for uncovering those merits. First, recipients are more likely to have positive expectations about the value of knowledge from ingroup sources because of a tendency to favor one's own group. Research, for example, consistently indicates that people regard others with whom they share a social identity more favorably than those with whom they do not share such an identity, making attributions that extend the proverbial "benefit of the doubt" more to ingroup members (Pettigrew 1979) and rating ingroup members as more trustworthy, valuable, honest, and loyal (for a review, see Hewstone et al. 2002). Second, recipient groups are likely to strive to uncover the value of knowledge from ingroup sources due to a desire for positive social identity. Groups that possess valuable resources are generally viewed as sources of positive social identity (Tajfel and Turner 1979). It seems reasonable to assume that a superordinate group would be viewed as a source of more positive social identity to the extent that it possesses more valuable knowledge. This suggests a psychological motive behind considering knowledge from an ingroup source thoroughly enough to uncover its merits. In particular, knowledge consideration, which offers the promise of uncovering valuable knowledge from a group with whom a superordinate identity is shared, is one way of satisfying members' desire for positive social identity. In sum, identification with a superordinate group such as a department, business unit, or organization, is expected to motivate recipients to consider another's knowledge, because sharing an identity increases the perceived benefit of engaging in this exploratory learning process that likely underlies knowledge transfer. This logic and evidence suggest the following effect of superordinate social identity on knowledge consideration.

HYPOTHESIS 2. *Recipient groups will consider a source group's knowledge more thoroughly when both groups share a superordinate social identity than when both do not.*

Knowledge Demonstrability and Superordinate Social Identity

Both knowledge demonstrability and superordinate social identity are expected to impact the likelihood of knowledge transfer through their effect on whether recipient groups determine the value of knowledge, which should occur when knowledge reveals its merits and when groups consider knowledge

thoroughly enough to uncover those merits. The conceptual model proposes that knowledge demonstrability impacts knowledge transfer by easing merit recognition, and superordinate social identity impacts knowledge transfer through its effect on knowledge consideration, the process through which recipient groups determine the value of another's knowledge. Because demonstrability is expected to affect the amount of consideration needed to recognize the merits of knowledge, and because sharing a superordinate social identity is expected to affect the thoroughness of knowledge consideration, superordinate identity is especially likely to be critical to the transfer of harder-to-recognize, less demonstrable knowledge. Such knowledge is likely to be prevalent in organizations, because clear approaches and solutions to tasks are few and far between. Requiring greater attention in order to recognize its merits, less demonstrable knowledge is more likely to transfer between groups with a superordinate identity, compared to groups without such an identity to motivate knowledge consideration. Thus, the effect of superordinate social identity on knowledge transfer is likely to be stronger when knowledge is less, rather than more, demonstrable. This theory and evidence suggest the following moderating effect of knowledge demonstrability on the relationship between superordinate identity and knowledge transfer.

HYPOTHESIS 3. *Superordinate social identity and knowledge demonstrability will interact to affect knowledge transfer, such that superordinate social identity will have a stronger positive effect on knowledge transfer when knowledge is less, rather than more, demonstrable.*

Method

Participants and design. Two hundred and sixteen students (50% women, 50% men, mean age = 20.2) from a private university in the eastern United States volunteered to participate. Participants reported their racial and ethnic identities, which yield the following sample statistics: 54% Caucasian, 41% Asian or Asian American, 3% Hispanic or Hispanic American, and 2% African American. For their participation in the experiment, 75% of the volunteers earned extra credit in one of their undergraduate business administration courses, while 25% of the volunteers received a ten-dollar payment. No differences were found across conditions or in any of the study variables on the basis of participant

compensation or racial and ethnic identity. For example, compensation was not associated with either ratings of superordinate social identity (F (1, 46) = .43, *ns*) or knowledge transfer (X^2 (1, N=48) = .0006, *ns*).

The study was a 2 (superordinate social identity: yes, no) X 2 (knowledge demonstrability: less, more) X 2 (production trial: trial 1, trial 2) mixed-model design, in which superordinate identity and knowledge demonstrability were between-subjects variables and trial was a within-subjects variable. Volunteers participated in one-hour sessions as part of two work groups: a recipient and a source group. Recipient groups contained three participants, and source groups contained a participant and two confederates. Student confederates of the experimenter standardized source group experience in the initial phases of the experiment. Single-gender sessions were run to control for gender composition and differential gender-based perceptions of expertise (e.g., Thomas-Hunt and Phillips 2004). Experimenters randomly assigned equal numbers of male and female sessions to the four (superordinate social identity X knowledge demonstrability) conditions, resulting in 12 observations per condition. A different group of 24 volunteers participated in a pre-test of the knowledge demonstrability manipulation.

Task. The task was an interdependent, production task with group-level knowledge in the form of routines for coordinating task execution. The general task specifications were for groups to work in a sequential assembly line to produce origami paper sailboats with at least one sail and a colored base (see Kane et al. 2005, for previous research using a similar task). Performance, which was calculated at the end of the entire experiment, was based on the finished goods inventory minus a small penalty for the work-in-process inventory. Groups earned a point for each sailboat produced, minus a tenth of a point for each unfinished sailboat. The primary mode of group activity was the execution of complex motor performances that require coordination and internal control: monitoring coordination, managing coordination, managing conflicts that arise, and monitoring quality (McGrath 1991).

Procedures

Modifications were made to the Kane et al. (2005) knowledge transfer paradigm in which personnel movement exposes a recipient group to a source group's knowledge embedded in a production routine.

Phase 1: Introduction and superordinate social identity manipulation. Upon entering a large room, six students each drew a paper indicating their group and a participant number associated with one of the following roles: recipient first assembler, recipient second assembler, recipient third assembler, source first assembler, source second assembler, and source third assembler. In the third phase of the experiment, the source second assembler (transferee) replaced the recipient second assembler, who transferred out of the recipient group. To abstract the dynamic, emergent nature of personnel movement, a randomly-assigned student participant rather than a confederate of the experimenter occupied the important transferee role. In order to standardize the transferee's experience prior to the third phase of the experiment, student confederates of the experimenter occupied the source first and third assembler roles. Experimenters explained the task and its specifications to participants, who were made aware that they would form three-person work groups that would move to separate rooms for training and production.

During the 10-minute introduction, experimenters began to induce participants to think of themselves as one six-person group comprised of two three-person work groups (superordinate social identity condition) or as two three-person work groups (no superordinate social identity condition). Superordinate social identity was induced with common fate, linguistic, and perceptual manipulations that have been used in previous studies (e.g., Gaertner et al. 1999; Kane et al. 2005; Kramer and Brewer 1984). A common fate was created with group rewards equivalent to $10 per participant to be won in a lottery drawn at the end of the semester in which the probability of winning was proportional to group performance. In the superordinate condition, participants in the six-person group whose two work groups collectively achieved the best performance were most likely to win the lottery; in the no superordinate condition, participants in the three-person work group with the best performance were most likely to win the lottery. Similar inducements of superordinate social identity via perceptions of common fate can be seen in organizational settings (e.g., Sethi 2000). In addition, work groups in the superordinate social identity condition shared the same name and color nametags, whereas groups in the no superordinate social identity condition had different names and color nametags. Experimenters counterbalanced the assignment of group names that either referenced the university or the geographic location of the

experiment. Experimenters gave each group member a nametag to wear for the remainder of the experiment with linguistic and perceptual representations of these social identities. During the introduction, groups in the superordinate condition sat in an integrated fashion around the table, whereas groups in the no superordinate condition sat at opposite ends of the table. Similar variations in physical space have been found to affect social identities in organizational settings (e.g., Millward et al. 2007).

Phase 2: Training and knowledge demonstrability manipulation. After the introduction, experimenters led work groups (a recipient and a source group) into separate, though similar, adjacent rooms. An experimenter spent 25 minutes training each group to use a production routine to make a sailboat that met the task specifications (i.e., in an assembly line produce origami paper sailboat with at least one sail and a colored base). The experimenter explained that the group would execute the task in a sequential assembly line for four production trials each lasting four minutes. Members were unaware that the first two trials were training trials, which then would be followed by membership transfer and two experimental trials. During the two training trials, groups executed the routine they had been trained to use, meeting task specifications though not necessarily using the most efficient or optimal routine.

Each recipient group learned to use a 12-step routine. Participants were unaware that the experimenter was training the source group in the adjacent room to use a different, more efficient, routine. The two confederates of the experimenter, who occupied the source group's first and third assembler roles, held constant the experience of the transferee during this set-up phase. Half of the transferees gained experience with a more demonstrable routine: source groups learned to use either a 7-step routine that resulted in a sailboat with a tall sail (more demonstrable knowledge) or a 7-step routine that resulted in a sailboat with short sails (less demonstrable knowledge). Both 7-step routines were objectively more efficient than the recipient group's 12-step routine[1]. The two 7-step routines varied in the degree to which their merits were readily perceived (high or low knowledge demonstrability). During production, the

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[1] Groups produced significantly more sailboats during the training trials when they used the 7-step routines ($M = 9.98$, $SD = 1.71$) compared to the 12-step routine ($M = 4.25$, $SD = 1.71$), ($t (94) = 18.74$, $p < .001$). By contrast, production did not differ significantly when groups used the 7-step routine that resulted in a sailboat with a tall sail ($M = 9.94$, $SD = 2.00$) compared to the 7-step routine that resulted in a sailboat with short sails ($M = 10.02$, $SD = 1.40$), ($t (46) = 0.16$, *ns*).

routine that resulted in a sailboat with a tall sail revealed its merits more readily than the routine that resulted in a sailboat with short sails. The former appeared likely to meet specifications efficiently, because it resembled a sailboat throughout production. Tall sails were folded first and then a small base was folded. By contrast, the sailboat with short sails did not appear likely to meet specifications efficiently, because it did not resemble a sailboat until completion of the penultimate fold (see Appendix A for diagrams of the steps).

Knowledge demonstrability pre-test. Because the use of a given routine was expected to alter perceptions of its demonstrability, experimenters collected ratings of knowledge demonstrability in a pre-test, rather than at the end of the experiment. To pre-test the 7-step routines, a separate group of 24 participants individually rated the demonstrability of the routines. Half of these participants rated the demonstrability of the routine with the tall sails, while the other half rated the demonstrability of the routine with the short sails. Before requesting ratings, the experimenter simulated what recipient group members would experience when a transferee began to work with them. That is, the experimenter executed the first five steps of the 7-step routine. Each participant rated on seven-point Likert scales the extent to which it: (1) resembled a sailboat that met specifications, (2) appeared difficult to complete (reverse scored), (3) appeared quick to complete, and (4) appeared easy to complete. Participants lastly rated (5) the perceived number of steps remaining. This five-item demonstrability scale displayed satisfactory reliability (Cronbach's α = .84). Participants in the pre-test reported that the routine with the tall sail was significantly more demonstrable (M = 4.82, SD = .82) than the routine with the short sails (M = 2.95, SD = 1.04), (t (22) = 4.92, p < .001).

Phase 3: Personnel movement and group production. After the second training trial, experimenters explained that groups would experience a change in membership. The second assemblers would replace one another and work with the other group during the final two production trials. Because the source group's role was to systematically endow each transferee with experience using a less or a more demonstrable routine, the group had served its purpose and thus ceased task engagement, ending the involvement of the two confederates of the experimenter. Meanwhile, since participants were unaware

that the original groups were using two different routines, they did not anticipate that personnel movement could result in the transfer of knowledge in the form of an efficient, 7-step production routine.

After personnel movement, reconfigured recipient groups, consisting of a recipient first assembler, a transferee, and a recipient third assembler, worked together for two production trials (Trial 1 and Trial 2), while the transferred-out participants provided a non-reactive measure of superordinate social identity. During Trial 1, the transferee encountered a similar work arrangement (e.g., physical characteristics of the room, configuration of the assembly line, and initial steps of the routine) and thus executed the same steps as in his or her initial group, thereby sharing the source group's routine. To resume task execution according to specifications (e.g., in a sequential assembly line), groups needed to monitor their coordination in order to recognize that members were using two different routines, and then resolve this through additional training. The group discussion during the critical period from when the transferee shared the source group routine until groups resumed production was transcribed. After the final trial, experimenters led groups back to a larger room where they debriefed and thanked participants.

Measures

Dependent measures. Knowledge transfer is a dichotomous measure (group used transferee's 7-step routine vs. group did not use transferee's 7-step routine), assessed directly from observation of the groups in Trial 1 and Trial 2. To examine the possibility that recipient groups would develop one of the 7-step routines on their own without exposure to a transferee, 48 participants were divided into 12 pilot groups that engaged in four consecutive production trials lasting four minutes each. Experimenters trained these three-person groups to produce sailboats in an assembly line using the 12-step routine. Although one group eliminated a step, no group developed either 7-step routine, suggesting that neither 7-step routine is likely to emerge without exposure to a transferee's knowledge. Although based on a small sample, the pilot study increases confidence that recipient groups' adoption of a transferee's 7-step production routine indicates that one group has been affected by another group's experience, which is the core of Argote and Ingram's (2000) definition of knowledge transfer.

The measure of knowledge consideration was obtained from transcripts of the critical discussion spanning from when the transferee shared the source group routine, until groups resumed production. To create a quantitative, group-level measure of knowledge consideration, two coders segmented each transcript into comparable units, which they then classified into mutually exclusive categories (Weingart 1997). The knowledge consideration category reflects the group focusing its attention on the source group's routine, including requests for and provision of information regarding characteristics of the routine, as well as evaluations and discussions of the merits of its adoption. The following examples satisfied the knowledge consideration criteria: "How do you finish it, though?," "It's only a triangular sail, two folds and you're done," and "I think her boat is easier than our boat." Knowledge consideration is distinct from the following two processes necessary for groups to recommence task execution: (a) monitoring coordination and (b) training a member. The monitoring category reflects recognition that members are not executing the same routine— a requirement of their sequentially interdependent coordination. The following examples satisfied the monitoring category criteria: "Did you guys make the same boat?" and "We made a different boat." The training category reflects instruction on executing either of the routines. The following examples satisfied the training criteria: "Okay, so you take it like this and fold it," and "It's supposed to go the other way so the sail is white." These final categories ensure that the knowledge consideration measure reflects the focusing of attention on the source group's routine.

After receiving training and a written manual, coders who were blind to experimental conditions and hypotheses unitized and coded transcripts from each group. Each uninterrupted utterance was coded as a single unit unless it contained more than one independent or non-restrictive dependent clause. For example, coders separated the following independent clause and non-restrictive dependent clause: "I'm trying to figure out which one is faster (first unit), because we've got to build a sailboat no matter what (second unit)." After resolving the few unitizing disagreements (Guetzkow's U = 0.0023), coders identified 898 comparable units of group discussion. Next, coders categorized each unit as knowledge consideration, monitoring, training, or other. Coders resolved their few disagreements (Cohen's κ = .96), identifying 152 knowledge consideration units, 152 monitoring units, and 355 training units.

Manipulation check. Measures of recipient groups members' superordinate social identity were collected immediately following personnel movement. Because measures were collected at this critical moment, it was important that the measurement process did not impact the newly formed recipient group, nor reveal the experimenter's intent (Campbell and Stanley 1963). The first measure assessed superordinate social identity with a self-report survey measure developed by Haslam et al. (1999) that has been used to establish the efficacy of similar experimental manipulations of social identity (Haslam 2004). In particular, each respondent indicated on a 7-point scale the importance of being a member of the group of six in the experimental session. To ensure that this measure of identification with the superordinate group was non-reactive, only transferred-out members of the recipient group responded to the survey. Thus, the transferred-out member, who had experienced the same social identity manipulation as fellow recipient group members, acted as an informant for the group. The second measure assessed superordinate social identity from the recipient group's behaviors, captured in videotape recording. Specific behaviors, such as incorporating an individual in a group discussion, provide a direct indication of social identity (Ashmore et al., 2004). A dichotomous variable was created to reflect whether recipient groups generally treated the transferee as a group member by incorporating him/her in the discussion that transpired after personnel movement until the newly reconfigured group resumed production. Groups that did not incorporate the transferee excluded the transferee from their group processes when generating and choosing among alternatives to resume task execution, either (a) acting as if the transferee had never entered the group, saying nothing to him/her, or (b) speaking about, rather than to, the transferee, stating for example: "What is he (*the transferee*) doing?" and " Should we teach her (*the transferee*) our way?" Groups that incorporated the transferee included him or her in their group process. The following statements reflected this incorporation: "How many should we try to make?" and "That doesn't look right." Two coders, blind to experimental condition and hypotheses, achieved satisfactory reliability (Cohen's $\kappa = 0.73$) in their coding of this behavioral indicator of superordinate social identity.

Results

Analyses of the superordinate social identity manipulation check are reported. To examine the effects of knowledge demonstrability and superordinate social identity on the likelihood of knowledge transfer, analyses of knowledge transfer are reported. In addition to reporting a direct test of the hypothesis that superordinate social identity increases the extent of knowledge consideration, mediation and mediated moderation analyses are presented to further understanding of the underlying process through which superordinate identity and knowledge demonstrability impact knowledge transfer.

Manipulation check. Analyses of the measures of superordinate social identity collected at the critical moment following personnel movement indicate that the manipulation was effective. First, a 2 (superordinate social identity condition) X 2 (knowledge demonstrability condition) analysis of variance (ANOVA) on the survey measure of superordinate social identity yielded one significant effect for superordinate identity condition (F (1,43) = 4.07, $p < .05$, $\eta^2 = .087$). Participants in the superordinate condition reported significantly higher levels of identification with the superordinate group ($M = 4.91$, $SD = 1.16$) than did participants in the no superordinate condition ($M = 4.17$, $SD = 1.30$). Second, a chi-square analysis of the behavioral measure of superordinate social identity revealed a significant effect of superordinate identity condition ($X^2 = 8.39$, $p < .01$). More recipient groups in the superordinate condition (75%) than in the no superordinate condition (33%) incorporated the transferee in their group discussion, a behavior reflective of superordinate social identity.

Knowledge transfer. Neither the recipient group nor the transferee were aware that the groups had been trained to use different production routines until the transferee used the source group's routine, which all transferees did in Trial 1 regardless of the (superordinate social identity X knowledge demonstrability) condition. Because knowledge transfer was a categorical variable measured at two points in time, Trial 1 and Trial 2, a weighted least squares regression technique for analyzing repeated-measures categorical data was utilized (Stokes et al. 2000). Correlated marginal proportions of the occurrence of knowledge transfer were modeled with an underlying contingency table that reflected the sampling structure and included four response profiles (knowledge transfer in Trial 1 and Trial 2: YY,

YN, NY, NN). The model yielded a significant main effect, which was qualified by a significant interaction discussed below. Consistent with prior research (Kane et al. 2005), the main effect for superordinate social identity (X^2 (1, $N = 48$) = 5.98, $p < .05$) indicated that knowledge was more likely to transfer to a recipient group in the superordinate than in the no superordinate condition. The marginal probability of knowledge transfer was 0.13 ($SE = .05$) higher for groups in the superordinate condition than for groups in the no superordinate condition. Knowledge demonstrability did not significantly affect the likelihood of knowledge transfer (X^2 (1, $N = 48$) = .12, ns); the marginal probability of knowledge transfer, -.02 ($SE = .05$), was not higher in one demonstrability condition compared to the other, providing no support for the first hypothesis. Finally, the effect of trial on knowledge transfer was not significant: the marginal probability of knowledge transfer was not higher in one trial compared to the other.

As predicted in the third hypothesis, there was a significant interaction between superordinate social identity and knowledge demonstrability (X^2 (1, $N = 48$) = 11.78, $p < .001$). Figure 1 and an additional statistical model (described below) facilitate interpretation of this interaction, which was hypothesized and found to result from superordinate social identity's stronger effect on knowledge transfer when knowledge was less, rather than more, demonstrable. As indicated by the left side of Figure 1, less demonstrable knowledge was more likely to transfer when groups shared a superordinate identity with the transferee than when they did not share such an identity. However, as indicated by the right side of Figure 1, more demonstrable knowledge was no more likely to transfer when groups shared a superordinate identity with the transferee than when they did not share such an identity.

[insert Figure 1 about here]

The same pattern emerges from the additional statistical model of knowledge transfer that employs nested-by-values effects coding— a procedure that uses all observations, but alters the parameterization. Compared to the full model reported above, this model replaces the parameter for superordinate social identity and the parameter for the interaction with one parameter for superordinate social identity conditional on less demonstrable knowledge and another parameter for superordinate social identity conditional on more demonstrable knowledge (see Stokes et al. 2000, p. 391). Results indicate

that the marginal probability of transferring less demonstrable knowledge was .32 ($SE = .06$) higher for groups in the superordinate condition compared to the no superordinate condition, whereas the marginal probability of transferring more demonstrable knowledge, -.05 ($SE = .09$), did not differ significantly for groups in the superordinate compared to the no superordinate condition. The interaction parameter in the full model tests the one-degree-of-freedom contrast of these conditional effects. The significant parameter estimate for the interaction of superordinate social identity and knowledge demonstrability ($B = -.19$, $SE=.05$, X^2 (1, $N = 48$) $= 11.78$, $p < .001$) provides strong support for the hypothesized moderation of the superordinate social identity effect on knowledge transfer by knowledge demonstrability.

Underlying Process. In order to investigate the process underlying these effects, an analysis of knowledge consideration was conducted. A 2 (superordinate social identity) X 2 (knowledge demonstrability) ANOVA on knowledge consideration yielded one significant effect for superordinate social identity (F (1, 44) $= 12.06$, $p < .05$, $\eta = .46$). Groups in the superordinate condition ($M = 4.88$, $SD = 4.35$) considered the transferee's routine to a greater extent than groups in the no superordinate condition ($M = 1.46$, $SD = 1.84$). These results support the second hypothesis and indicate that recipient groups consider knowledge from a source more thoroughly when both share a superordinate social identity than when both do not share such an identity. A plausible alternative explanation for these results is that groups that shared a superordinate social identity with the transferee were more comfortable conversing than groups that did not share such an identity with the transferee. This possibility was examined with a 2 (superordinate social identity) X 2 (knowledge demonstrability) ANOVA on the total number of units of group discussion that occurred following personnel movement. There was not a significant effect of superordinate social identity (F (1,44) $= .40$, *ns*, $\eta = .01$), indicating that the greater degree of consideration in the superordinate compared to no superordinate condition is not a function of the former being more talkative than the latter. Similar analyses of the monitoring and training measures yielded no significant differences across social identity conditions (F (1,44) $=.39$, *ns*, $\eta = .01$ and F (1,44) $=.36$, *ns*, $\eta = .01$, respectively). These results indicate that superordinate social identity increased knowledge consideration but did not increase the amount of group discussion, monitoring, or training.

Mediation and mediated moderation analyses were conducted to better understand the underlying process. First, knowledge consideration was investigated as a mediator of the superordinate social identity effect on knowledge transfer. Second, the investigation turned to whether this mediating process accounted for the moderating effect of knowledge demonstrability. Whereas mediation analyses identify an intervening process that leads from a treatment X to an outcome Y (Baron and Kenny 1986), mediated moderation analyses investigate whether a mediating process ME accounts for the interaction of a treatment X and a moderator MO (Baron and Kenny 1986; Muller et al. 2005). Knowledge consideration might account for the moderation tested in the third hypothesis, because the impact of thorough consideration on knowledge transfer likely differs for more demonstrable and less demonstrable knowledge. Groups need to make inferences and thoroughly consider knowledge that is less demonstrable in order to recognize its merits. But seeing the merits of more demonstrable knowledge requires fewer inferences, which should render consideration less important to knowledge transfer as the demonstrability of knowledge increases.

To test for mediated moderation, the Muller et al. (2005) extension of the Baron and Kenny (1986) classical approach of estimating models to check necessary and sufficient conditions was adopted. One estimates the following moderated versions of the classic models and tests for two conditions.

$$(1) \quad Y = \beta_{10} + \beta_{11}\, X + \beta_{12}\, MO + \beta_{13}\, X{*}MO + \varepsilon_1$$

$$(2) \quad ME = \beta_{20} + \beta_{21}\, X + \beta_{22}\, MO + \beta_{23}\, X{*}MO + \varepsilon_2$$

$$(3) \quad Y = \beta_{30} + \beta_{31}\, X + \beta_{32}\, MO + \beta_{33}\, X{*}MO + \beta_{34}\, ME + \beta_{35}\, ME{*}MO + \varepsilon_3$$

The first condition of mediated moderation is moderation of the overall treatment effect ($\beta_{13} \neq 0$). The second condition is met when the moderation of the residual treatment effect in model 3 is smaller than the moderation of the overall treatment effect in model 1 ($\beta_{33} < \beta_{13}$). For the latter condition to occur, one or both of the indirect paths from the treatment via the mediator to the outcome must be moderated ($\beta_{23} \neq 0$ and/or $\beta_{35} \neq 0$).

The weighted least squares regression method for analyzing repeated measures categorical data, described in the knowledge transfer section, was used to estimate knowledge transfer in models 1 and 3. Repeated measures estimation techniques increase statistical power, which is essential when using the classical approach to estimating mediation, because a lack of adequate power is the primary weakness of the classical approach (MacKinnon et al. 2002; Muller et al. 2005). To perform the estimation outlined in model 3, the measure of knowledge consideration was dichotomized at its median (2). In order to maximize comparability across models, a logistic regression methodology was used to estimate knowledge consideration in model 2. The three models are shown in Table 1 and described below.

[insert Table 1 about here]

The first model established the initial mediation condition: an overall treatment effect (superordinate social identity) on knowledge transfer ($B_{11} \neq 0$). The second model established the second mediation condition: a treatment effect on the mediator (knowledge consideration) ($B_{21} \neq 0$). The third model established the third mediation condition: an effect of the mediator on knowledge transfer, controlling for the treatment ($B_{34} \neq 0$). Finally, the residual treatment effect in the model that controlled for the mediator was smaller than the overall treatment effect in the first model ($B_{31} < B_{11}$). The coefficient associated with the treatment effect was reduced in magnitude from 0.13 (model 1) to 0.05 (model 3). Model 3 also revealed that the residual treatment effect on knowledge transfer was no longer significant ($B_{31}= -0.05, SE = .03, X^2 (1, N=48) = 2.42, ns$). Thus, the fourth and final condition of mediation was met.

Next, mediated moderation was investigated. Consistent with hypothesis 3, model 1 established the first additional condition of mediated moderation. The overall treatment effect depended on a moderator (knowledge demonstrability) ($B_{13} \neq 0$). The second additional condition was met by comparing models 3 and 1. In model 3, the moderation of the residual treatment effect when controlling for the mediator was smaller than the moderation of the overall treatment effect in model 1 ($B_{33} < B_{13}$). The coefficient associated with the moderation of the treatment effect (superordinate social identity X knowledge demonstrability) was reduced in magnitude from 0.19 (model 1) to .05 (model 3). As seen in

model 3, which included the mediator (knowledge consideration) and the moderation of the mediator (knowledge consideration X knowledge demonstrability), the moderation of the residual treatment effect (superordinate social identity X knowledge demonstrability) was no longer significant (B_{33} = .05, SE = .05, X^2 (1, N=48) = .045, ns). Thus, the second additional condition of mediated moderation was met. In order for these conditions to be met, one or both of the indirect paths from the treatment via the mediator to the outcome must be moderated ($B_{23} \neq 0$ and/or $B_{35} \neq 0$). Indeed, moderation of an indirect treatment effect was observed along the path from the mediator to the outcome ($B_{35} \neq 0$).

Together, these analyses indicated that the mediating effect of knowledge consideration accounted for the moderation by knowledge demonstrability of the superordinate social identity effect. Knowledge demonstrability affected the magnitude of the partial effect of knowledge consideration on knowledge transfer in model 3 (and this was found in conjunction with a superordinate social identity effect on knowledge consideration in model 2). The coefficient associated with the moderation of the indirect treatment effect (B_{35} = -.11) reflected an attenuation of the mediator effect on knowledge transfer as knowledge demonstrability increased. Further examination of model 3 also revealed an interesting result, an effect of knowledge demonstrability on knowledge transfer (X^2 (1, N=48) = 3.94, $p < .05$). Whereas model 1 excluded knowledge consideration and did not yield a knowledge demonstrability effect, model 3 included the direct and indirect moderated effects of the mediator, revealing that the marginal probability of knowledge transfer was .07 (SE = .03) higher in the more demonstrable than in the less demonstrable knowledge condition. The results of the mediation and mediated moderation analyses are displayed in Figure 2 and summarized below.

[insert Figure 2 about here]

Knowledge consideration mediated the relationship between the superordinate social identity manipulation and knowledge transfer. Groups that shared a superordinate social identity with the transferee considered his/her knowledge more thoroughly than groups that did not share a superordinate identity with the transferee, and greater consideration led to a higher likelihood of knowledge transfer. Furthermore, this mediating process accounted for superordinate social identity having a stronger effect

on the transfer of less, rather than more, demonstrable knowledge. In particular, knowledge consideration had a stronger impact on knowledge transfer as knowledge demonstrability decreased, because groups needed to consider knowledge more thoroughly to recognize its merits when it was lower in demonstrability. Along related lines, groups engaging in average amounts of knowledge consideration were more likely to adopt a transferee's knowledge when it was more, rather than less, demonstrable.

Discussion

Results generally support the conceptual model and contribute to understanding of *when* and *how* superordinate social identity and knowledge demonstrability impact the likelihood that organizations capitalize on their knowledge resources. Groups unlocked the knowledge transfer potential arising from personnel movement more often when they shared a superordinate identity than when they did not share such an identity, and this identity effect was moderated by knowledge demonstrability. When knowledge was less demonstrable with concealed merits, it was more likely to transfer between groups that shared a superordinate identity, compared to groups that did not share such an identity. By contrast, when knowledge was more demonstrable with apparent merits, it was as likely to transfer between groups that shared a superordinate identity compared to groups that did not share such an identity. In sum, superordinate social identity impacted knowledge transfer more when the merits of knowledge were concealed than when they were apparent, suggesting the power of superordinate identity to unlock the potential of the myriad organizational ideas, routines, and practices that are low in demonstrability.

Analysis revealed how superordinate social identity and knowledge demonstrability impact knowledge transfer. Superordinate social identity was found to promote knowledge transfer by promoting the process of knowledge consideration, the focusing of recipient group attention on determining the value of another's knowledge. Mediated moderation analyses indicated that this exploratory learning process accounted for the moderating effect of knowledge demonstrability on the relationship between superordinate social identity and knowledge transfer. Superordinate social identity induced thorough knowledge consideration, which was more important for recognizing the value of

knowledge whose merits were concealed rather than apparent. As a result, the impact of superordinate identity on knowledge transfer through knowledge consideration was greater for the transfer of less, rather than more, demonstrable knowledge. Taken together, results indicate that knowledge consideration is an important process underlying knowledge transfer with knowledge demonstrability affecting the *need* for knowledge consideration and superordinate social identity affecting the *extent* that groups consider knowledge.

Results suggest that superordinate social identity increases knowledge consideration, though such consideration is not a prerequisite for recognizing and benefiting from more demonstrable knowledge. Greater than half of the groups receiving a transferee with more demonstrable knowledge adopted his or her easier-to-recognize knowledge, regardless of whether they shared a superordinate identity. The frequency with which more demonstrable knowledge transferred in this study is comparable to rates of knowledge transfer in field settings (e.g., Galbraith 1990; Szulanski 1996), where existing knowledge creates barriers to the adoption of new knowledge (e.g., Lant et al. 1992). Evidence of a knowledge demonstrability effect was found in the statistical model that also controlled for knowledge consideration, despite the lack of evidence of a demonstrability effect in the model that only controlled for superordinate identity. In other words, recipients engaging in average amounts of knowledge consideration adopted the transferee's knowledge more when its merits were apparent than when they were concealed. This suggests that in contexts where cognitive resources are limited, organizations could benefit from focusing knowledge transfer efforts on highly demonstrable knowledge.

When more elaborate and contextualized understandings are required, recipient groups are able to learn more from a transferee with whom they share an identity than from a transferee with whom they do not share such an identity. This sense of belonging to a superordinate group seems to function in a fashion analogous to belonging to a team that has worked together and developed a transactive memory system— a collective system for encoding, storing, retrieving and communicating group knowledge (Lewis et al. 2005). Both exhibit an ability to leverage and transfer knowledge through learning by doing. This type of learning can be particularly effective when contextual changes (i.e., membership changes and

interruptions) impact performance (Argote 1999). In contrast to research that links interruptions directly to attentional switches and mindful behavior (Okhuysen and Eisenhardt 2002; Zellmer-Bruhn 2003), when groups shared a superordinate identity with a transferee and were presented with an interruption in the form of new knowledge, they shifted their attention away from their own routine to consider an alternative routine. This suggests that groups may need to view an interruption as an opportunity to learn rather than as a disturbance to their current processes in order to initiate knowledge consideration.

By investigating conditions under and processes through which superordinate social identity affects knowledge transfer, this study makes significant contributions toward a deeper understanding of knowledge transfer and the links among theories of social identity, organizational learning, knowledge management, and group learning. The study advances understanding beyond research that found superordinate social identity to have a stronger effect on the transfer of superior, rather than inferior, quality knowledge (Kane et al. 2005). In particular, superordinate social identity appears to promote knowledge transfer, especially when knowledge is less demonstrable, because it increases an exploratory learning process— consideration of another group's knowledge. Discovering that knowledge demonstrability impacts the effect of superordinate social identity on knowledge transfer via knowledge consideration is likely to contribute to work on organizational learning and knowledge management (e.g., Argote et al. 2003; Szulanski 1996), superordinate or common identity (e.g., Gaertner and Dovidio 2000; Rink and Ellemers 2008), social identity in organizations (e.g., Ashforth and Mael 1989; Haslam 2004), and group learning (Edmondson 2002; Wilson et al. 2007). Uncovering when knowledge consideration is likely and necessary for knowledge transfer contributes to research examining mindful and less mindful collective learning processes (Argote and Todorova 2007; Levinthal and Rerup 2006; Okhuysen and Eisenhardt 2002; Weick and Sutcliffe 2006; Zellmer-Bruhn 2003).

This study has implications for how organizations manage work groups and units in order to leverage their knowledge resources. Because few work groups face tasks with clear task specification or solutions, the preponderance of organizational knowledge is low in demonstrability and requires some consideration to recognize its merits. Consequently, in order to capitalize on the knowledge transfer

potential arising from contemporary management practices that increase knowledge availability, such as dynamic group membership and project-based work (Lewis et al. 2007; Mortensen et al. 2007), managers could promote employees' identification with, or sense of belonging to, a superordinate group, such as a cross-functional or geographically-distributed unit, department, division, or organization. How might managers promote the formation and maintenance of superordinate social identity? Clues may be gleaned from procedures that experimenters successfully employed to induce a superordinate identity in this research. The procedure of assigning a common name, color, and physical space suggests that management use analogous symbolic and perceptual tools to promote superordinate identity. Reinforcing these cues, experimenters also induced members of work groups to share a common fate. In particular, a monetary prize was awarded to superordinate group members in a lottery where the chances of winning were proportional to the combined performance of their two work groups. This suggests that managers base a noticeable portion of employee evaluations and bonuses on superordinate-level performance in order to promote superordinate identity. Future research is needed to determine whether symbolic and perceptual cues need to be reinforced with a common fate in order to promote a superordinate identity strong enough to affect knowledge transfer.

Although this setting capitalized on the strengths of experimental methodologies, the study is not without its limitations. On the one hand, randomly assigning a participant to transfer between groups enabled the abstraction of important dimensions of personnel movement and dynamic membership, which are not as well captured in studies that use confederates in this role. On the other hand, in order to ensure that each transferee's source group experience was consistent, two student confederates of the experimenter occupied the first and third source group assembler roles during the set-up phases of the experiment. Although it is unlikely, confederates may have influenced the transferee in unmeasured ways that co-varied systematically with experimental conditions. An additional limitation resulting from social interaction during interdependent task performance was the experimenter's constrained ability to collect participants' perceptions during the knowledge transfer process without creating demand characteristics.

Such data would advance understanding of the extent that perceptions of groups and knowledge need to be shared among members in order to affect knowledge consideration and knowledge transfer.

Future work on knowledge transfer could investigate the generalizability of these results to contexts that require more or less thorough consideration, such as what might occur when there are variations in group and knowledge characteristics. For example, groups that have developed or chosen specific routines are likely to be committed to those routines. Commitment to existing routines has been shown to impede the adoption of new routines (Choi and Levine 2004); in such situations, greater consideration might be necessary for groups to overcome resistance to new knowledge. The nature of group tasks may also impact generalizability. Knowledge consideration may be even more important for groups that not only use knowledge to produce goods and services, but also produce knowledge, such as consultants, developers and researchers, because their tasks rarely have specifications or approaches that are as clear as those modeled in this research. Along related lines, the importance of superordinate identity to knowledge transfer may also vary with characteristics of knowledge, such as complexity and relevance. Knowledge complexity depends in part on the modularity of source and recipient knowledge, because the complexity of a system increases with the number of parts and their interaction (Simon 1996). Conversely, modular systems have few interactions between their parts and are less complex (Schilling 2000). Knowledge relevance may also be a boundary condition to the findings in this study, because motivation to process information tends to increase with perceptions of its relevance (Petty and Wegner 1998). Future work could investigate whether these and other group and knowledge characteristics affect the need for consideration, which might interact with superordinate identity and thereby affect knowledge transfer.

This work has important strategic implications for organizations whose performance and survival depend on effective knowledge management. To the extent that organizational routines, practices, and ideas are implemented by groups within, but not outside, the boundaries of the organization, knowledge transfer has the greatest potential to confer a competitive advantage (Argote and Ingram 2000). The current study highlights the importance of superordinate social identity in the transfer of less

demonstrable— though objectively useful— knowledge that is likely to remain within organizational boundaries because its merits are hard to recognize. By impacting whether recipients consider knowledge thoroughly enough to recognize its merits, superordinate social identity appears to be an important key to unlocking the potential of such strategically valuable knowledge.

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Figure 1
Knowledge transfer occurrence in trial 1 as a function of knowledge demonstrability and superordinate social identity
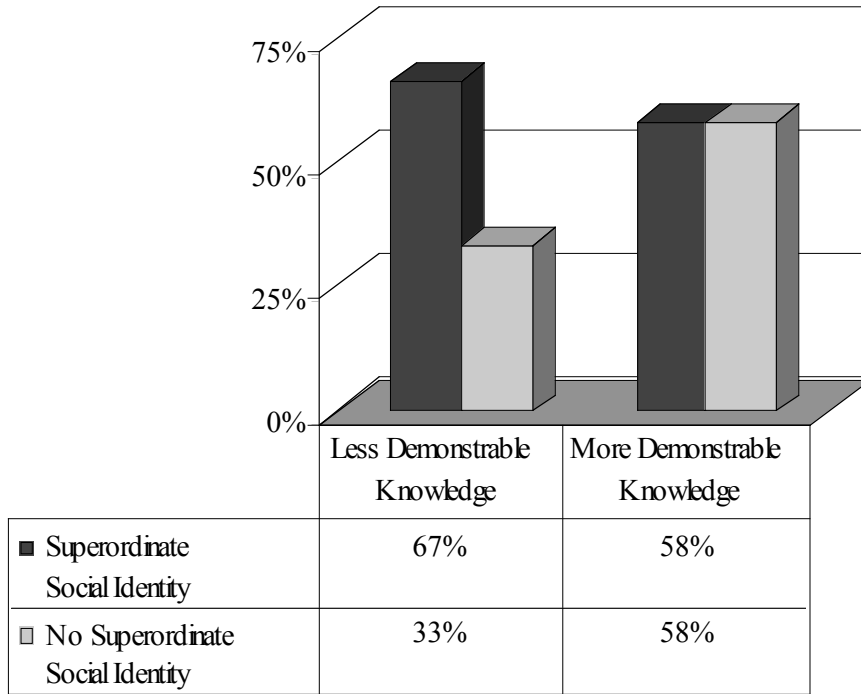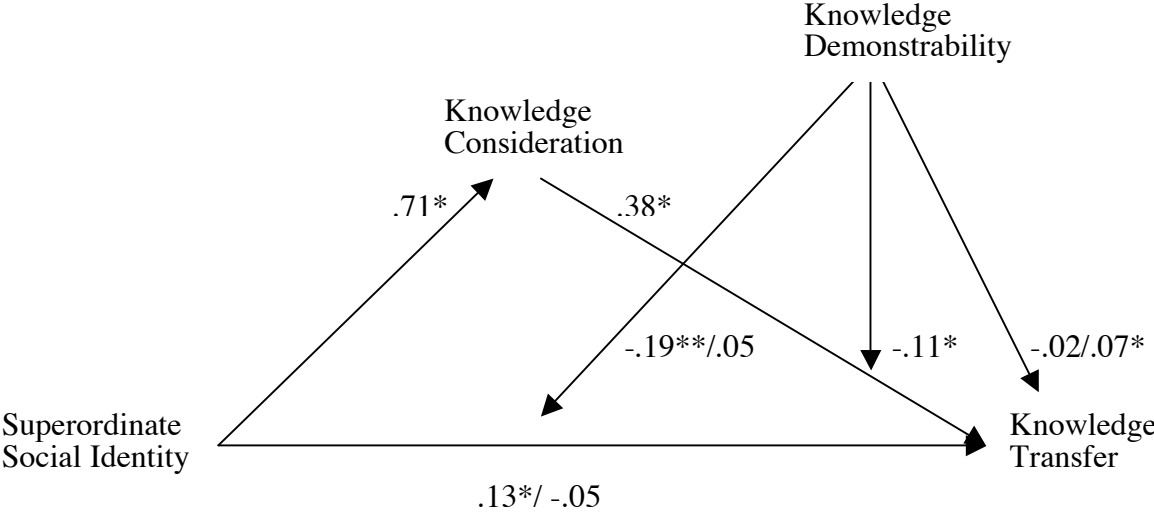

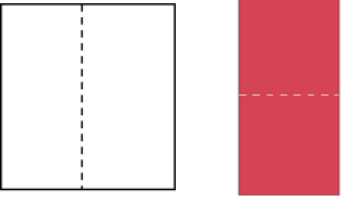|	Less Demonstrable Knowledge	More Demonstrable Knowledge
■ Superordinate Social Identity	67%	58%
□ No Superordinate Social Identity	33%	58%

Figure 2
Knowledge consideration mediation and mediated moderation

Knowledge
Demonstrability

Knowledge
Consideration

.71*   .38*

-.19**/.05   -.11*   -.02/.07*

Superordinate
Social Identity   Knowledge
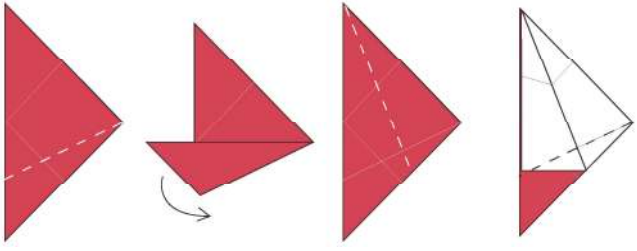   Transfer
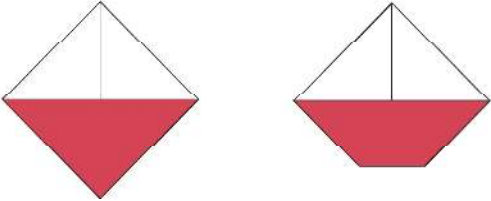
.13*/ -.05

*p <.05   ** p <.01
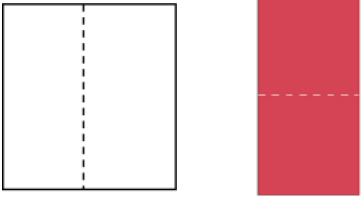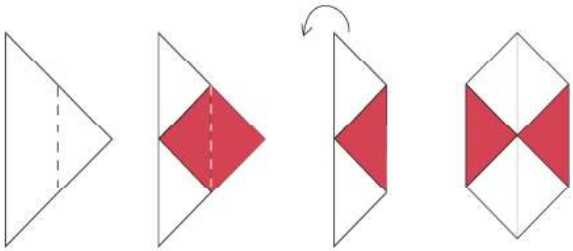
Table 1
Knowledge consideration mediation and mediated moderation analyses

	Parameter Estimates and Standard Errors (in parentheses)		
	Model 1	Model 2	Model 3
Model	$KT_{(t1,t2)} = B_{10} +$ B_{11} SSI $+ B_{12}$ KD $+ B_{13}$ SSI*KD	$KC = B_{20} +$ B_{21} SSI $+ B_{22}$ KD $+ B_{23}$ SSI*KD	$KT_{(t1,t2)} = B_{30} +$ B_{31} SSI $+ B_{32}$ KD $+ B_{33}$ SSI*KD $+$ B_{34} KC $+ B_{35}$ KC*KD
Intercept	0.66 ** (.05)	0.19 (.31)	0.57 ** (.03)
Superordinate Social Identity (SSI)	0.13 * (.05)	0.71 * (.31)	-0.05 (.03)
Knowledge Demonstrability (KD)	-0.02 (.05)	0.01 (.31)	0.07 * (.03)
Superordinate Social Identity X Knowledge Demonstrability (SSI*KD)	-0.19 ** (.05)	0.01 (.31)	0.05 (.03)
Knowledge Consideration (KC)			0.38 * (.03)
Knowledge Consideration X Knowledge Demonstrability (KC*KD)			-0.11 * (.03)
X^2 Goodness of Fit Statistic (a)	14.24		9.27
df	11		9
p	0.22		0.41
n	48	48	48

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

(a) Smaller X^2 and correspondingly larger p-values indicate better fitting models.

Appendix A

Less Demonstrable Production Routine	More Demonstrable Production Routine
Initial Steps	Initial Steps
Interim Steps	Interim Steps
Final Steps	Final Steps