Knowledge Transfer in Teams and Its Role for the Prevention of Knowledge Loss

by

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Knowledge retention may be a matter of survival or a secondary concern for your organization today. But for virtually every organization – large or small – reducing the costs of lost knowledge is going to become an increasingly compelling issue.

David DeLong, 2004

How can an organization transfer knowledge effectively? The short answer, and the best one, is: hire smart people and let them talk to one another.

Davenport and Prusak, 1998
## Table of Contents

Acknowledgements ................................................................................................................................. 5

General Introduction............................................................................................................................... 8

Outline ............................................................................................................................................... 13

1. **Knowledge, Knowledge Management, and Knowledge Transfer** ........................................... 16
   1.1. Definitions of Knowledge-Related Terms ........................................................................... 16
   1.2. Conclusions and implications for the study design ............................................................... 28
   1.3. Positioning Within Knowledge Management ....................................................................... 31
   1.4. References .......................................................................................................................... 34

2. **A Multilevel Investigation of Antecedents of Knowledge Sharing and Seeking in Teams** ... 39
   2.1. Abstract ............................................................................................................................ 39
   2.2. Introduction ....................................................................................................................... 40
   2.3. Empirical and Theoretical Background ............................................................................. 42
   2.4. Method ............................................................................................................................. 55
   2.5. Results ............................................................................................................................. 60
   2.6. Discussion ......................................................................................................................... 66
   2.7. Conclusion ......................................................................................................................... 75
   2.8. References ........................................................................................................................ 76
   2.9. Appendix .......................................................................................................................... 86

3. **Intergenerational Knowledge Transfer in Work Teams: A Multilevel Social Network Perspective** ........................................................................................................................................... 88
   3.1. Abstract ............................................................................................................................ 88
   3.2. Introduction ....................................................................................................................... 89
   3.3. Theoretical Background ....................................................................................................... 91
   3.4. Method ............................................................................................................................. 102
   3.5. Results ............................................................................................................................. 108
   3.6. Discussion ......................................................................................................................... 113
   3.7. Conclusion ......................................................................................................................... 122
   3.8. References ........................................................................................................................ 123

4. **Preventing Knowledge Loss When Employees Expect to Leave: Effects of Expected Turnover on Knowledge Transfer and Interactions with Perceived Supervisor Support** .......... 132
   4.1. Abstract ............................................................................................................................ 132
   4.2. Introduction ....................................................................................................................... 133
   4.3. Theoretical and Empirical Background ............................................................................. 135
   4.4. Method ............................................................................................................................. 142
# Table of Contents

4.5. Results ......................................................................................................................... 147
4.6. Discussion ...................................................................................................................... 153
4.7. Conclusion ...................................................................................................................... 162
4.8. References ..................................................................................................................... 163
4.9. Appendix ...................................................................................................................... 173

5. **General Discussion** .................................................................................................. 174

5.1. Recurrent Issues Across Papers .................................................................................... 174
5.2. Limitations .................................................................................................................... 178
5.3. Attainment of Research Objectives .............................................................................. 183
5.4. Future Directions ......................................................................................................... 186
5.5. Contributions to the Field of Knowledge Management .............................................. 188
5.6. Concluding Remarks .................................................................................................... 191
5.7. References .................................................................................................................... 192
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General Introduction

In today’s “knowledge society”, knowledge and its application are the basis of power and the key to success (Drucker, 1993). For organizations, knowledge has come to be one of the most important assets, a productive resource that yields competitive advantage (Alavi & Leidner, 2001; Argote & Ingram, 2000; Argote, Ingram, Levine, & Moreland, 2000; Szulanski, 1996). In the management literature, this idea of knowledge as the most important productive resource is called the knowledge-based view of the firm (Grant 1996, 1997; Spender, 1996), and researchers from different fields have shown empirically that the creation and dissemination of knowledge leads to better performance at the individual, team, and firm level (Collins & Smith, 2006; Cummings, 2004; Darr, Argote, & Epple, 1995; Mesmer-Magnus & DeChurch, 2009; Quigley, Tesluk, Locke, & Bartol, 2007; van Wijk, Jansen, & Lyles, 2008). Thus, knowledge has to be managed, i.e., created, captured, organized, accessed, and used (Dalkir, 2005), so that organizations can take advantage of and use this most precious resource knowledge.

There is at least one circumstance, however, that threatens parts of such valuable knowledge, and that is the demographic change. The demographic change, which we are facing in most of the industrialized countries, is affecting a wide array of issues at the societal and personal level. But it does not only affect pension plans, create jobs in the care and health industries, or alter the target groups of advertising; the demographic change has very specific consequences for organizations and their workforces as well. It leads to larger cohorts of older employees and extended work lives for older workers (Leibold & Voelpel, 2006; Ng & Feldmann, 2008; Vaupel & Loichinger, 2006). These changes within the workforce call for health issues to be solved, especially where labor is physically strenuous; hiring and further training of older employees becomes a must, entailing the necessity of changes in routines and procedures so far mostly targeting young applicants and learners; negative images of aging
and of older workers have to be dealt with and fought, and age diversity has to be managed. And these are just a few examples. For knowledge management, the larger cohorts of older employees are a major problem as they now begin to reach retirement age. Thus, big waves of employees are about to leave organizations and will take with them all the knowledge and experience gathered during decades of employment. If no measures are taken, this valuable knowledge is lost to the organizations. This can incur immense costs by inducing a reduction in the capacity to innovate, threatening the ability to pursue growth strategies, reducing efficiency, and giving competitors an advantage (DeLong, 2004; Leibold & Voelpel, 2006).

Of course, one might argue that older employees have always been leaving organizations and have been replaced by younger ones without much further ado. Therefore, a few more retirees should not constitute such a problem. The present situation, however, is not only characterized by a large wave of retiring employees, but there are several other circumstances, partly also related to the demographic change, that magnify the risk of knowledge loss, and turn it into a serious problem.

First, career paths of the younger generations are changing. While for the generation of employees who are now starting to retire it was characteristic to stay in the same company for most of their working lives, younger employees nowadays tend to be less willing to remain with the organization (e.g., D’Amato & Herzfeldt, 2008; Lancaster & Stillman, 2002). Thus, not only are knowledgeable older workers leaving the organizations, but there are additionally more turnover incidents from younger experts to deal with. Consequently, there is even more knowledge at risk of being lost today.

Second, the demographic change does not only entail larger cohorts of older employees, but also fewer younger workers entering the workforce (Leibold & Voelpel, 2006; Vaupel & Loichinger, 2006). Although there is some debate as to whether the demographic change will, for this reason, lead to a significant labor shortage (DeLong, 2004; Leibold & Voelpel, 2006),
there is a unified belief that we will be facing a shortage of qualified workers. This is thought to produce the often cited “war for talent” (Michaels, Handfield-Jones, & Axelrod, 2001). Accordingly, it cannot be expected that successors will have the same qualifications as their predecessors and will be able to easily fill their shoes. Consequently, keeping the knowledge of leaving employees within the company is even more important and in the present situation.

Third, and most important, the nature of knowledge in organizations itself has changed (DeLong, 2004; Leibold & Voelpel, 2006). Partly due to the vast development of information and communication technologies, knowledge has become much more specialized and complex. Especially in domains like science, engineering, and other technical fields, the introduction of ever more potent computers has led knowledge to be much more diversified, complex and extensive. At the same time, the work in knowledge-intensive domains has become much more interdisciplinary. For example, a researcher in psychology nowadays does not only have to deal with much more sophisticated statistical procedures (a rise in complexity), but also has to know more about related disciplines such as biology, sociology, or neurology (a rise in interdisciplinarity). Consequently, employees working under such conditions as just described develop an expertise that is much more difficult to replace than was an employee’s knowledge a generation ago (DeLong, 2004). Thus, the risk for organizations to lose knowledge is much more pronounced today than it was before.

Being faced with this threat of losing invaluable resources, organizations are well advised to take action. To this end, several strategies have been proposed in the literature. DeLong (2004) argues that the prevention of knowledge loss has to be addressed throughout an employee’s career: starting with the attraction and recruitment of young employees to whom knowledge from leaving employees can be transferred to, leading over to the retention of mid-career employees who could leave with huge amounts of critical knowledge, and culminating
in the smooth transition of retiring employees into their past-work-life. Consequently, a large set of measures is necessary to address the threat of knowledge loss, with measures usually belonging to one or more of several broader categories, for example Human Resource policies and practices, improvement of knowledge transfer practices, information technologies or knowledge recovery programs (DeLong, 2004). As of yet, these measures and strategies have been proposed in theoretical works or referred to in practical literature on best practices, but they have not been systematically tested. Despite the urgency of the topic, there have not been any empirical investigations of effects of these strategies more generally, and, more specifically, of effects on the threat of knowledge loss in organizations.

The present dissertation focuses on one of these broader strategies, namely on the increase and improvement of knowledge transfer. This strategy for the prevention of knowledge loss was chosen as knowledge transfer is the most basic and crucial aspect of retaining knowledge within the organization; in some way or another, the knowledge at question has to be transferred from the retiree to the successor or other employees who will need to use it. For this reason, the strategy of increasing and improving knowledge transfer usually forms part of suggestions for knowledge retention, not just the ones brought forth by DeLong (e.g., Droge & Hoobler, 2003; Leibold & Voelpel, 2006). This presence in most knowledge retention models again increased my interest in studying knowledge transfer out of the different possible strategies.

Thus, the aim of the present dissertation was to investigate knowledge transfer between employees as a means to fight knowledge loss. To this end, I wanted to find out how employees’ knowledge transfer can actually be encouraged and by what it might be impaired. Beyond “general” knowledge transfer between employees, my special interest was directed at intergenerational knowledge transfer, as in the situation of retiring employees it is usually a veteran employee who should transfer knowledge to a younger colleague or successor. Last
but not least, I wanted to know if day-to-day knowledge transfer can really be an adequate pathway to the prevention of knowledge loss.

In order to answer these questions, I conducted two questionnaire studies and collected two datasets. The first study formed part of the “demopass”-project, a large interdisciplinary study conducted at the Jacobs Center for Lifelong Learning and Institutional Development at the Jacobs University Bremen. The overall aim of this project was to investigate effects of matches and mismatches between aspects of human and social capital, business strategy and work organization on physical and mental health at the workplace (Heidemeier et al., 2009). One out of five foci in the “demopass”-project was the study of (mis-)matches and their consequences for the knowledge management in organizations. The data basis used in the first study was collected for this focus area of the “demopass”-project.

The second study was designed specifically for the purpose of this dissertation and was conducted at a public administration in Germany. In the following, an outline of the dissertation, which is written in the format of a cumulative dissertation, will be given.
Outline

The core of the present dissertation consists of three research papers that were written to be published in scientific journals and that have been slightly adapted for the present format. The three articles are linked by a red thread, and, together, draw a picture of knowledge transfer as a path to the prevention of knowledge loss. As there are some basic terminologies and concepts that all three articles build upon, an introductory chapter is added to explain these common grounds. All three empirical chapters describe the respective theoretical background, the methods used, and results obtained, and wrap up with a discussion of the specific results. A concluding chapter is then devoted to the discussion of the results of the dissertation as such. References and appendices are provided for each chapter separately.

In chapter one, the main terms and concepts revolving around knowledge are clarified and explained, including knowledge, knowledge management, and knowledge transfer. This is followed by a brief discussion of implications of the given definitions for the study of knowledge loss. Moreover, a brief overview of knowledge management as a discipline will be given and the present work will be positioned within this broader context.

Chapter two consists of the first research paper and describes the first study, which formed part of the “demopass”-project and examined predictors of knowledge transfer between employees. There is a considerable amount of literature on predictors of knowledge transfer, but due to inconclusive and inconsistent results as well as the large variety of possible predictors proposed and studied, there is as yet no clear understanding of the underpinnings of knowledge transfer (Argote, 1999; Ko, Kirsch, & King, 2005; van Wijk et al., 2008). Thus, I propose and test two important differentiations which can help disentangle predictor effects: the distinction between individual and team level effects of predictors, and the distinction between the effects on two different knowledge transfer behaviors, namely
knowledge sharing and knowledge seeking. These propositions are tested in a multivariate, multilevel study using three important predictors: age, motivation, and job autonomy.

In chapter three, which represents the second research paper, one of the two questions that motivated the second study is presented. The focus here lies on a form of knowledge transfer that is of specific interest for the prevention of knowledge loss: intergenerational knowledge transfer. Following up on an age effect on knowledge sharing found in the first study, I wanted to investigate if older employees generally transfer more knowledge irrespective of the age of their vis-à-vis, or if they transfer more specifically to younger employees. This would shed light on the question if intergenerational knowledge transfer naturally occurs to an increased extent or if it rather has to be inspired and encouraged. Furthermore, I wanted to explore the underlying basis of a potentially increased knowledge transfer between older and younger employees and investigate if it goes beyond a simple difference in job experience. To answer these research questions, a social network approach was combined with a multilevel analysis in order to not only obtain dyadic information, but test individual and team level predictors at the same time.

Chapter four contains the third paper, which reports on further findings from the second study. In the first two papers, I was rather interested in different forms of knowledge transfer between employees and what makes this transfer happen. In this paper, however, I tried to get closer to the question if encouraging knowledge transfer really is an appropriate strategy to prevent knowledge loss. To this end, I investigated what happens to knowledge transfer in situations that potentially constitute a threat of knowledge loss, i.e., I looked at the knowledge sharing behavior of employees who intended or expected to leave the organization. Furthermore, I examined the role of the supervisor in such situations. Again, multilevel data were used to analyze the influence of intended turnover and expected (involuntary) turnover.
on knowledge sharing, as well the influence of perceived supervisor support on knowledge sharing.

In chapter five, the results of the different papers are linked, and their limitations and relevance are discussed, as is the question if the original aim of the dissertation has been reached. Furthermore, future research ideas are presented.
1. Knowledge, Knowledge Management, and Knowledge Transfer

Before I describe the research I have done within the framework of this dissertation, there are a few terms that need to be clarified. For example, to be able to understand and set into perspective the hypotheses generated, studies conducted, and results obtained, a (working) definition of knowledge, which is the central concept of this dissertation, should be given. Similarly, terms like knowledge management, knowledge transfer, knowledge sharing, and knowledge seeking have to be explained.

In addition to these definitions, the present chapter presents some practical considerations of the threat of knowledge loss and knowledge retention. Based on these considerations, implications are described for study sample, knowledge type, and knowledge transfer situations to be examined in empirical studies, and the respective choices made for the present dissertation are presented.

Before concluding the chapter and leading over to the first study, I will position my work within the field of knowledge management to allow the reader to better judge the relevance of the present work.

1.1. Definitions of Knowledge-Related Terms

1.1.1. Knowledge

Knowledge is defined by the Oxford English Dictionary as

1.) (i) facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject;

(ii) the sum of what is known;

(iii) information held on a computer system;

(iv) true, justified belief; certain understanding, as opposed to opinion (Philosophy);
2.) awareness or familiarity gained by experience of a fact or situation;

3.) sexual intercourse (archaic).

Number one, two, and three refer to different homonyms. Only the definitions under number one refer to the concept of knowledge that is relevant to the present context. Interestingly, there are four different definitions given for this concept, which already demonstrates that it is difficult to give one all-encompassing definition for knowledge.

The question of what constitutes knowledge has a long tradition and is still being debated within the field of epistemology, the discipline dedicated to this issue. In the western tradition, this debate originated with the Greek philosophers Plato and Aristotle; Plato introduced the above mentioned definition of knowledge as “true, justified belief”, and took a rather rationalist perspective by considering knowledge as something that is achieved by rational reasoning. His student Aristotle, on the other hand, assumed an empiristic perspective, and proclaimed that knowledge can only be gained through sensory experience. The debate between Rationalism and Empiricism has been literally going on for centuries, with several attempts of a synthesis, for example by Kant, Hegel, and Marx in the 18\textsuperscript{th} and 19\textsuperscript{th} century. A shared agreement between these and other streams of epistemology has as yet not been reached, so there is still no one agreed-upon definition of knowledge. Maybe one of the reasons for the lack of such a universal definition is that knowledge can have a different meaning in different contexts and environments. As for the present work, I do not need a philosophical definition of knowledge, but rather a practical definition of knowledge in organizations. Such definitions, which have been proposed in the management and business literature, are presented in the following.
1.1.2. Knowledge in organizations

Unfortunately, just like the more philosophical concept of knowledge, knowledge in the context of organizations lacks a general, agreed-upon definition. Nevertheless, there exists a striking similarity that the various definitions share and that we can build on: The fact that knowledge is usually demarcated from information. This constant demarcation is owed to the circumstance that one of the disciplines that have been very active in knowledge management research is information technology (IT).

IT approaches usually distinguish three entities: data, information, and knowledge, and these they order hierarchically (Alavi & Leidner, 2001; Davenport & Prusak, 1998). Data is typically described as raw, discrete, and objective numbers and facts (Alavi & Leidner, 2001; Davenport & Prusak, 1998). As such, data provides neither judgment nor interpretation, it rather builds the raw material for the creation of information (Davenport & Prusak, 1998). Information is processed data, i.e., data to which meaning or purpose has been added by contextualization, categorization, calculation, correction, or condensation (Alavi & Leidner, 2001; Davenport & Prusak, 1998). Knowledge is information that is connected, compared, and authenticated with reference to a whole network of other pieces of information (Alavi & Leidner, 2001; Davenport & Prusak, 1998).

The distinction between information and knowledge is a tricky one and less obvious than the distinction between information and data. Many organizations already have IT systems for information management in place, such that the necessity arises to explain why knowledge is so much different and has to be managed on its own. The clue to the distinction is that knowledge is tied to the individual. Alavi and Leidner (2001) for example describe knowledge as “information possessed in the mind of individuals: it is personalized information” (p. 109); while Nonaka and

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1 This distinction between data, information, and knowledge was also used to answer questions about what was considered knowledge in study one as well as in the introductory information sessions for participants in study two.
Takeuchi (1995) call it a “dynamic human process of justifying personal belief toward the ‘truth’” (p. 58). Knowledge is created and resides within the mind, and heavily relies on the individual’s beliefs, values, judgment and experience (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Nonaka, 1994; Nonaka & Takeuchi, 1995). According to Davenport and Prusak (1998), the knowledge existing within a person provides a framework for evaluating and incorporation new information. Thus, knowledge in organizations is not seen as an objective truth as in the traditional philosophic discussions, but is rather subjective (which is why it is so hard to transfer, as we will see later). Furthermore, knowledge is rather dynamic, as it changes depending on new information and experiences (Machlup, 1983; Nonaka, 1994).²

But knowledge can not only exist at the level of the individual, it can also become embedded in groups (e.g., social knowledge) or in organizations. At the organizational level, knowledge can be created by a process that “amplifies the knowledge created by individuals and crystallizes it as a part of the knowledge network of the organization.” (Nonaka, 1994, p.17). It is then embedded in documents and repositories, but also in organizational routines, processes, practices, and norms (Davenport & Prusak, 1998).

For its role in organizations, it is important to note that knowledge is closely related to action and increases the capacity for effective action, respectively (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Nonaka, 1994; Nonaka & Takeuchi, 1995). “Better knowledge can lead, for example, to measurable efficiencies in product development and production.” (Davenport & Prusak, 1998, p. 6).

Summing all this up in one or two sentences is all but easy, but for the purpose of the present dissertation, my working definition of knowledge reads as follows:

² Despite all efforts to distinguish between information and knowledge, there is a certain overlap, and in practice, the line between these two constructs is sometimes impossible to draw. Therefore, when addressing question of participants, I opted rather for a broader, comprehensive definition of knowledge.
Knowledge is a dynamic network of different pieces of information, experiences, values, beliefs, observations, and judgments. Knowledge primarily resides within the individual, and creates the capacity for action.

As knowledge is such a broad concept, different characteristics and types of knowledge have been distinguished, and various taxonomies or classifications have been developed. As certain characteristics of knowledge are linked to its transferability, I will now briefly describe some of these proposed distinctions.

1.1.3. Different types of knowledge

One of the most widely-cited distinctions is the one between explicit and tacit knowledge, which Nonaka (1994) explicated based on the work of Polanyi (1962, 1966). Explicit or codified knowledge can be articulated and communicated in symbolic form (e.g., writing) and/or in natural language, and is rather discrete or digital (Alavi & Leidner, 2001; Nonaka 1994). Tacit knowledge, on the other hand, is rooted in action and experience, and involved in a specific context. It comprises a cognitive element referring to an individual’s mental models (schemata, mental maps, beliefs, paradigms, viewpoints) and a technical element (concrete knowhow, crafts, skills) (Alavi & Leidner, 2001; Nonaka 1994). According to Nonaka (1994) and Nonaka and Takeuchi (1995), explicit and tacit knowledge are complementary entities that can interact with and be transformed into each other (knowledge conversion).

While an often-drawn conclusion holds that tacit knowledge is more valuable for organizations, I keep with Alavi and Leidner (2001) in that both dimensions of knowledge are important and, thus, have to be protected against knowledge loss. Of course, explicit knowledge is much easier to transfer and protect against loss than tacit knowledge.
In a similar vein, Szulanski (1996) described other characteristics of knowledge in organizations, such as unprovenness (lacking a proven record of past usefulness) or causal ambiguity (an incomplete understanding of how and why this piece of knowledge works), which enable the classification of different types of knowledge that are more or less transferable. In empirical studies, Szulanski (1996) and Szulanski, Cappetta, and Jensen (2004) could demonstrate that causal ambiguity has a direct as well as moderating influence on the transferability of knowledge.

Other classifications often take a content-based approach, either in a more abstract manner, e.g., differentiating between declarative (know-about / knowledge by acquaintance), procedural (know-how), causal (know-why), conditional (know-when), social (created by / inherent in collective actions of a group), and relational (know-with) knowledge; or in a very concrete manner, e.g., differentiating between knowledge about customers, products, processes, and competitors, including best practices, software codes, project experiences, or tools (Alavi & Leidner, 2001).

All these different classifications show that there are very different types of knowledge which are distinct with respect to certain characteristics. Whereas the explicit-tacit distinction and characteristics such as unprovenness and causal ambiguity rather refer to characteristics of knowledge that have relevance for storage and transferability of knowledge, the content-based distinctions rather say something about what the knowledge comprises, where it might be found and used, how valuable it is etc. Thus, the content-based categorization might convey information on the necessity of protecting the respective type of knowledge against loss, but not necessarily information on the transferability of this knowledge type.

For the present dissertation, the question arises if all these types of knowledge are threatened by knowledge loss in the same manner, and if they can be protected by being transferred. But before I can dwell on this question, I first have to clarify what I refer to by using the term
knowledge transfer. As knowledge transfer forms part of knowledge management, I start by defining the latter.

1.1.4. Knowledge management

A logical consequence of the knowledge-based view of the firm (Grant 1996, 1997; Spender 1996), which sees knowledge as an important, if not the most important organizational resource, is that knowledge has to be managed. New developments in the information and communication technologies facilitated such aspirations, as organizations are now “increasingly able to gather and process information from a variety of new sources” (Ferguson, Mathur, & Shah, 2005, p. 51). Of course, knowledge management is not limited to IT solutions and systems. Rather, it is a systematic approach to ensure the full utilization of the organization’s knowledge base to create a more efficient and effective organization (Dalkir, 2005). Typical knowledge management objectives have aims such as creating knowledge repositories, identifying and improving accessibility of knowledge resources within the organization, building up or improving a knowledge culture, or, on a broader scale, minimizing the loss of corporate memory due to attrition and retirement (Alavi & Leidner, 2001; Dalkir, 2005; Davenport & Prusak, 1998). This is achieved by a process involving four main activities or processes, which some authors might label differently or subdivide into other, finer processes, but which usually read as follows: 1) creating, 2) storing and retrieving, 3) transferring, and 4) applying knowledge (Alavi & Leidner, 2001).

Knowledge creation describes a process through which new content (new to the organization) is developed or acquired, with the aim of increasing the stock of knowledge or replacing existing content within the organization’s knowledge base (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Pentland, 1995). Nonaka (1994) and Nonaka and Takeuchi (1995) developed the widely cited dynamic theory of organizational knowledge creation, identifying
four modes of knowledge creation (socialization, externalization, internalization, and combination) which operate through the interplay of tacit and explicit knowledge in a spiral movement between the individual, the group, and the organization. In addition to this theory and the research it stimulated, innovation and creativity research has surely helped to fill the “black box” that knowledge creation, according to Davenport and Prusak (1998), constituted for many organizations. Some practical examples for knowledge management tools directed at knowledge creation would be knowledge acquisition (e.g., hiring people or buying entire organizations), knowledge rental (e.g., hiring a consultant or trainer), or dedicating resources (e.g., establishing a research and development department) (Davenport & Prusak, 1998).

Knowledge storage, organization, and retrieval are aimed at creating an organizational memory (Stein & Zwass, 1995; Walsh & Ungson, 1991). Once knowledge is created, it has to be made accessible for others and protected against oblivion, so that it can add value for the organization in the future. In this area of knowledge management, IT solutions play a large role as they can facilitate the storage and access to certain types of knowledge (Pentland, 1995). But knowledge can be stored in various forms, such as written documentation, electronic databases, documented organizational procedures and processes, and tacit knowledge acquired by individuals and networks of individuals (Alavi & Leidner, 2001).

Knowledge transfer is concerned with the process of getting the rather distributed knowledge to locations where it is needed and can be applied (Alavi & Leidner, 2001; Pentland, 1995). Knowledge transfer is directed from a source unit to a recipient or target unit, with different possible transition channels (Gupta & Govindarajan, 2000; Szulanski, 1996). For this knowledge management process, again, IT solutions play an important role, as do paper-based systems and face-to-face social interaction (Pentland, 1995). Examples for knowledge management initiatives directed at the establishment or encouragement of knowledge transfer are knowledge fairs, mentoring programs, or communities of practice (Davenport & Prusak, 1998).
With knowledge application, the “knowledge that has been captured, coded, shared, and otherwise made available is put to actual use” (Dalkir, 2005, p. 145). Without this last step, knowledge management efforts have been in vain, and there is no possibility of obtaining the intended performance improvement. The source of competitive advantage resides in the application of knowledge rather than in the knowledge itself (Alavi & Leidner, 2001; Dalkir, 2005; Pentland, 1995). Application can take many forms, for example a change in a procedure, a new product, or a system change.

This brief overview of knowledge management shows that knowledge transfer is only one element of and closely intertwined with other elements of knowledge management. Nevertheless, as knowledge transfer is a central concept in this dissertation, it merits a more detailed examination, which I present in the next section.

1.1.5. Knowledge transfer

Argote and Ingram (2000, p. 151) defined knowledge transfer in organizations as “the process through which one unit (e.g., group, department, or division) is affected by the experience of another.” Further, these authors suggest that knowledge transfer in organizations involves knowledge transfer between individuals, but, transcending the individual level, also includes transfer at the group, product line, department, or division level. Along the same lines, Alavi and Leidner (2001) posit that transfer occurs at various levels, that is between individuals, from individuals to explicit sources (e.g., electronic knowledge repositories), from individuals to groups, between groups, across groups, and from the group to the organization.

Many studies have empirically shown that the transfer of knowledge has an influence on several organizational outcomes such as individual performance (Quigley et al., 2007), work group performance (Cummings, 2004; Mesmer-Magnus & DeChurch, 2009), firm or franchise
productivity (Collins & Smith, 2006; Darr et al., 1995; van Wijk et al., 2008), and innovativeness (van Wijk et al., 2008). This is not surprising, as knowledge is a productive resource which multiplies as it gets transferred, because “shared knowledge stays with the giver while it enriches the receiver” (Davenport and Prusak, 1998, p. 17). Of course, the focus of the present dissertation is not the multiplication for the benefit of productivity, but the “reproduction” of knowledge with the aim of preventing its loss when the original piece of knowledge leaves with its owner. As it is single employees who leave and whose knowledge has to be retained by transfer to a successor or colleague, the knowledge transfer between individuals is of prior interest here. Accordingly, in the following, the focus will be on knowledge transfer at the individual level. This is one of the most basic ways of transferring existing knowledge in organizations (Bock, Zmud, Kim, & Lee, 2005; Watson & Hewett, 2006), as knowledge is created by and thus primarily resides in individual employees (Nonaka, 1994). Slightly deviating from Argote and Ingram (2000), I define individual knowledge transfer (in organizations) as the process through which one employee receives knowledge from another. I use the term “employee” instead of “unit” as I refer to the individual level, employ the term “knowledge” instead of “experience” as, according to my working definition of knowledge, knowledge is more than just experience, and use the term “receives” instead of “is affected by” as an employee can be affected by another’s knowledge without knowledge transfer taking place.

This process of knowledge transfer, of course, includes various different behaviors, activities and processes. For example, Szulanski (1996) describes four different stages of knowledge transfer. Although he refers to the transfer of best practices between business units, this stage model can also be applied to individual level knowledge transfer. The four stages are: initiation, which comprises events that lead to the transfer, e.g., the search for a specific piece of knowledge, implementation, which is the actual transmission of knowledge, ramp-up, which refers to the stage of first uses of the new knowledge by the recipient, and integration, during
which the new knowledge is routinely used and integrated into the knowledge base of the recipient.

In contrast to this stage model, I do not consider the use of new knowledge as a necessary part of knowledge transfer, but rather as a consequence of knowledge transfer—just as it is considered by Alavi and Leidner (2001) as a knowledge management process separate from knowledge transfer. I will focus mainly on two different knowledge transfer behaviors which spotlight the two different agents engaged in knowledge transfer: knowledge seeking (by the seeker or recipient) and knowledge sharing (by the knowledge source). Following Gray and Meister (2004), I define knowledge seeking as a behavior by which an individual actively accesses another’s knowledge, regardless of the form of knowledge, or the communication channel employed. Similarly, with knowledge sharing I refer to a behavior by which one individual shares knowledge with another, regardless of the form of knowledge, the communication channel used, or the initiating party of the transfer. This distinction and why it is important will be explained in more detail in chapter two, where it is of crucial importance. Notwithstanding this focus on seeking and sharing, I agree with Davenport and Prusak (1998) in that for transfer to be successful, knowledge has not just to be sought, but eventually absorbed by the recipient.

As will be further presented in chapter two, individual transfer has been investigated by researchers from a variety of fields, with a specific focus on facilitators and barriers of knowledge transfer (Faraj & Sproull, 2000; Oshri, Fenema, & Kotlarsky, 2008; Srivastava, Bartol, & Locke, 2006; Staples & Webster, 2008; Thomas-Hunt, Ogden, & Neale, 2003). Having defined knowledge, knowledge management, and knowledge transfer, one other concept that has already been frequently referred to still stands to be clarified: knowledge loss. This is done in the following section.
1.1.6. Knowledge loss

Knowledge loss is described by DeLong (2004) as a “decreased capacity for effective action or decision making in a specific organizational context” (p. 21) which is due to “retirement, turnover of younger employees, reorganization, or reassignment, or lack of access to knowledge archives” (p. 22). Just as knowledge exists and can be transferred at different levels within the organization, knowledge can also be lost at different organizational levels, such as the individual, group, or organizational level. In this dissertation, I focus on the exit of individual employees and on how individual knowledge transfer can possibly prevent knowledge loss. Nevertheless, it is important to notice that such an exit can lead to knowledge loss at the group or even organizational level, as it can have implications for the working group or the organization as a whole. Consequences of knowledge loss can be very diverse, depending on the knowledge that is lost. Sometimes they are immediate and tangible, such as production downtimes. In other cases they can be delayed and rather intangible, such as a less innovative output due to a lost contact to sources outside the organization. On a higher level, strategic implications can take the form of reduced capacity to innovate, a threatened ability to pursue growth strategies, reduced efficiency, giving competitors an advantage, or just being increasingly vulnerable (DeLong, 2004).

Having clarified the most crucial concepts with respect to the present work such as knowledge, knowledge management, knowledge transfer, and knowledge loss, I will now briefly discuss a few conclusions that can be drawn from these explanations, which again have implications for the study sample I should use and the knowledge type and knowledge transfer situation I should consider.
1.2. Conclusions and implications for the study design

In the previous sections, different types and characteristics of knowledge have been described, and it seems obvious that not all types of knowledge are equally threatened to be lost. With respect to knowledge characteristics, explicit knowledge, for example, is less vulnerable to knowledge loss than tacit knowledge as it is far easier to document (although an effort to document it still has to be made). In a similar manner, certain knowledge types or knowledge contents are exposed to a greater threat of knowledge loss than others, and the loss of some contents would have more severe consequences than others. As DeLong (2004) puts it, “losing a veteran accountant or HR manager may be temporarily disruptive, but not as costly as losing a key salesperson managing internal accounts” (p. 27). Thus, as different departments or units usually possess different types or contents of knowledge, the threat of knowledge loss differs across such divisions: According to DeLong (2004), the threat of losing knowledge is especially pertinent in research and development departments as well as in organizational domains with knowledge that is critical for productivity gains, efficiency, continued performance improvements, or for running sophisticated systems (computer or otherwise). Additionally, organizational areas with individuals who engage in extensive personal relationships, e.g., to costumers or providers, are prone to the loss of knowledge. In general, it can be said that whenever single employees exclusively possess a certain piece of knowledge that is critical to the functioning of a task, a team, a division etc., this knowledge is extremely valuable and at a greater risk of being lost.

Consequently, not every single retiree’s knowledge has to be meticulously retained (because it exists somewhere else in the organization and will not be lost), and not every team, division or even organization is equally affected by the threat of knowledge loss. For example, results of a study by King and Zeithaml (2003) indicate that organizational knowledge resources vary significantly across industries and even among companies within the same industry.
Furthermore, organizations do not necessarily want to retain all the knowledge they could possibly lose (DeLong, 2004). When older employees leave, this does not only pose a possible threat, but can also constitute a chance to get rid of outdated or no longer wanted knowledge (e.g., procedural knowledge on how things have always been done), and an opportunity for new knowledge and ideas to be introduced. As a matter of fact, in interviews and talks with study participants, mainly from middle and upper management, I oftentimes encountered that successors did not want to receive any (again, primarily procedural) knowledge from their predecessors, as the successors wanted to develop their own style and gather their own experiences.

Considering these arguments, it is obvious that only specific types of knowledge in organizations are at risk of being lost and only the failure to retain certain retirees’ knowledge equals knowledge lost to the organization. There can exist entire teams of employees who are all doing the exact same tasks so that, if one of them leaves, this employee can be easily replaced without knowledge being lost. On the other hand, there are certain specialists within organizations who bear the exclusive responsibility for a certain task, and the loss of their knowledge would have detrimental consequences for the organization.

Accordingly, the question arises if for the present dissertation project, a specific sample is necessary that consists of employees (or teams, or units) who possess especially critical knowledge. Of course, such a sample would be ideal, but is very difficult to obtain as oftentimes even the organizations themselves are not clear about who possesses such knowledge (Davenport & Prusak, 1998). But such a sample is not strictly necessary under the following conditions: First, I do not investigate knowledge loss directly, but rather if knowledge transfer as such can be considered a promising strategy for the prevention of knowledge loss (that is, how it can be increased, if it specifically exists between younger and older employees, and if it is different for employees who are expecting to leave). Second, I assume that employees who possess critical
knowledge do not differ in their knowledge transfer behavior from employees without such knowledge.

Another question that arises in the context of knowledge loss and the typologies presented in the last sections is what kind of knowledge transfer has to be looked at, or, in other words, the transfer of what kind of knowledge should be investigated. As argued before, tacit knowledge is hard to document, and knowledge transfer through extensive personal contact seems to be the only way it can be prevented from being lost. Thus, it seems promising to focus on such tacit knowledge. On the other hand, explicit knowledge can be just as valuable as tacit knowledge, and should not be neglected. Depending on the context, any kind or type of knowledge can be valuable for the organization and at risk of being lost, no matter if it is explicit, tacit, unproven, causally ambiguous, procedural, semantic, or conditional. Thus, the type of knowledge transferred that is studied should be rather broad, as there is no knowledge characteristic or type of knowledge that is of larger or lesser interest. Of course, at a later step, it would be very interesting to investigate if results differ for different kinds of knowledge or knowledge characteristics.

Related to this, the question of knowledge transfer situations to be studied occurs. As stated in the section on knowledge management (1.1.4), there are many possible transfer channels or situations, such as electronic databases, email, face-to-face-conversations, knowledge-fairs, mentoring programs, or communities of practice. Again, the focus should not be too specific, as critical knowledge can be transferred in all of these situations, and focusing on mentoring programs for example would imply focusing on a very specific sample of employees and a very specific sample of organizations that actually foster such relationships. “Everyday knowledge transfer”, that is, the naturally occurring, spontaneous, unstructured knowledge transfer between colleagues (Davenport & Prusak, 1998), is not tied to a specific sample, but should happen in any organization and team. Encouraging and improving such spontaneous knowledge exchange
is one of the essential elements of knowledge management (Davenport & Prusak, 1998), and models of knowledge retention strategies claim that knowledge practices must be part of day-to-day work (DeLong, 2004; Leibold & Voelpel, 2006). Furthermore, everyday knowledge transfer is a good choice as, according to Davenport and Prusak (1998), it is local (albeit fragmentary). As, according to DeLong (2004), the knowledge retention of individual employees’ knowledge is also “local”, this seems an appropriate study context.

Thus, the focus of this dissertation will be on everyday knowledge transfer, without a specification of certain types or characteristics of knowledge or specification of a certain type of employee sample. More concretely, the focus will be on everyday knowledge transfer within work teams, that is with colleagues working in the same work group or team.

Before I now proceed to the first study and paper, I would like to briefly position my work within the broader field of knowledge management so as to better enable the evaluation of the relevance and importance of research questions and results.

1.3. Positioning Within Knowledge Management

In section 1.1.4., I described knowledge management as a process which involves several activities with the aim to use an organization’s knowledge to its benefit. In the present section however, I am considering knowledge management as a research field that is divided into several subfields within which the present dissertation is to be positioned.

Figure 1 depicts an attempt of such a positioning within the field of knowledge management. The field of knowledge management, in equivalence to the process knowledge management, can be divided into four subfields, namely knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application (Alavi & Leidner, 2001). The present research is, of course, situated within the field of knowledge transfer. Knowledge transfer, then, can be
subdivided according to the organizational level at which the transfer is taking place. This yields at least three broad subfields, such as transfer between individuals, i.e., at the individual level, between teams or groups, i.e., at the team or unit level, and between organizations, i.e., at the organizational level. Especially the second category “team or unit level” is a rather broad one and could be further split into transfer at the group, product line, department, and division level (Argote & Ingram, 2000). Here, the dissertational work is situated within the subfield of knowledge transfer at the individual level. Concerning the knowledge transfer between individuals, many different transfer types or contexts have been investigated, and many more are possible. Individuals can transfer knowledge for example to colleagues within the team or outside the own team, within the framework of communities of practice or mentoring relationships. As stated above, I am looking at knowledge transfer within teams.

As can be seen in Figure 1, further specifications and subdivisions would be possible, such as according to knowledge type and / or transmission channel under investigation. But, as stated before, I will neither focus on a specific type or characteristic of knowledge nor will I focus on any particular communication channel. Thus, the present dissertation looks at one specific form of knowledge management, at a specific organizational level, within a specific context.
Figure 1. Positioning of the present research within the field of knowledge management, whose size is only adumbrated here. The darkest blocks are the ones that are covered.
1.4. References


2. A Multilevel Investigation of Antecedents of Knowledge Sharing and Seeking in Teams

This is the first of three chapters that present the empirical work conducted for the present dissertation and that are based on research papers that have been written independently for the purpose of publication in scientific journals. Of course, these papers have been slightly adapted in terms of format and content. Nevertheless there is still a certain overlap with information presented in chapter one, as I tried to preserve the original character of each of the three papers. Furthermore, these three chapters differ from chapters one and five in that instead of referring to the author as “I”, I will be referring to “us”, thereby acknowledging that these papers received a non-negligible input from other researchers, who will also co-author these papers upon publication.

The present empirical chapter, which is based on data collected in the “demopass”-project, focuses on the prevention strategy against knowledge loss that is at the core of the present dissertation: knowledge transfer. The study that is reported here examines how knowledge transfer can be encouraged, and, above all, what has to be taken into account when antecedents of knowledge transfer are investigated.

2.1. Abstract

This study examines the predictors of knowledge transfer in work groups and investigates the impact of age, motivation, and job autonomy on knowledge sharing and knowledge seeking at the individual and team level.

Using multivariate multilevel modeling, results of a survey study in two German mid-sized companies (N = 571) show that intrinsic motivation is positively related to knowledge

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sharing and seeking, but extrinsic motivation only to knowledge seeking. Age positively affects sharing, but seeking negatively. Job autonomy shows differential effects concerning the level of analysis: it positively influences sharing at the individual but not at the team level, whereas there is a relationship with seeking only at the team and not at the individual level. Given these findings, we argue that researchers must take differences between knowledge sharing and seeking at the individual and team level into account, since aggregated analyses may lead to inaccurate and inconclusive results.

2.2. Introduction

The creation and transfer of knowledge are a basis for competitive advantage in firms (Alavi & Leidner, 2001; Argote, Ingram, Levine, & Moreland, 2000; Argote & Ingram, 2000; Szulanski, 1996). In empirical investigations, knowledge transfer is therefore gaining increasing attention (Argote et al., 2000; Argote, McEvily, & Reagans, 2003; Cummings, 2004; Foss, Husted, & Michailova, 2010; Quigley, Tesluk, Locke, & Bartol, 2007) and has been shown to influence several organizational outcomes (Argote & Ingram, 2000; Kogut & Zander, 1996). Researchers from many different disciplines study knowledge transfer, such as psychology (Baldwin & Ford, 1988; Osterloh & Frey, 2000; Singley & Anderson, 1989), information technology (Jarvenpaa & Staples, 2000; Wasko & Faraj, 2005), and strategic management (Grant, 1996; Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka & von Krogh, 2009; Zander & Kogut, 1995). Owing to the diversity inherent in these different approaches, knowledge transfer has been studied at various levels and in various contexts within the organization, for example, between firms (Powell, Koput, & Smith-Doerr, 1996; Song, Almeida, & Wu, 2003; Uzzi & Lancaster, 2003), between a single organization’s different business units (Hansen, 1999, 2002; Szulanski, 1996), and within teams (Oshri, van Fenema, & Kotlarsky, 2008; Staples & Webster, 2008). Accordingly, building on these very different
theoretical approaches and looking at very different situations, a large variety of knowledge transfer antecedents has been proposed and studied in the last decade (Argote et al., 2000; Foss et al., 2010; van Wijk, Jansen, & Lyles, 2008).

Nevertheless, results are somewhat inconclusive and inconsistent, there are still considerable gaps, and it is difficult to see clear patterns regarding the most important factors leading to employees’ knowledge transfer (Argote, 1999; Foss et al., 2010; Ko, Kirsch, & King, 2005; van Wijk et al., 2008). We argue that the picture becomes clearer when effects are disentangled with respect to two factors; that is, if knowledge sharing and knowledge seeking are analyzed as two different behaviors, and if the level of analysis is taken into account. For example, Gupta and Govindarajan (2000) observed that not all behaviors that constitute knowledge transfer have the same antecedents. In their study, they found that, at the subsidiary level, motivation was decisive for knowledge sharing, but not for knowledge receiving. Furthermore, it has been found in many research areas that a predictor can work differently at different levels (Bliese, 1998; Chan, 1998; Firebaugh, 1978). In the public health or educational literature, this problem is well known. For example, individual poverty may have a negative impact on health outcomes (due to bad nutrition, less money for medical expenses etc.), but the impact of aggregated neighborhood poverty on health might even be stronger, as the lack of a medical infrastructure or sports facilities adds to the aforementioned effects (Schwartz, 1994). Surprisingly, although this problem of differing effects is well known in other disciplines and the method of analyzing multiple levels simultaneously is gaining increasing importance (Enders & Tofighi, 2007), the distinction between effects at different levels has not yet received much attention in the knowledge transfer literature (Foss et al., 2010; Quigley et al., 2007).

We suggest that to distil the most important influences on knowledge transfer, it is necessary to take a closer look and specify for a certain predictor which transfer behavior it
affects, and at which organizational level it exerts its influence. The aim of the present study is to establish these two distinctions. We aspire to do this in the following way: First, we want to give strength to the argument that knowledge sharing and knowledge seeking have to be distinguished by demonstrating in a joint (i.e., multivariate) analysis of antecedents that effects differ depending on the behavior considered. Second, we propose that predictor effects should be separated into individual- and group-/contextual-level effects instead of studied as an aggregate by demonstrating in a multilevel analysis that effects at the different levels can be very different. In an empirical investigation, we provide and test three basic factors that influence knowledge transfer within teams, but which we assume to differentially affect knowledge sharing and seeking (at different levels).

2.3. **Empirical and Theoretical Background**

Knowledge is created by and resides foremost in individual employees (Nonaka, 1994). The knowledge transfer between such individual employees is one of the most basic ways of transferring existing knowledge in organizations (Bock, Zmud, Kim, & Lee, 2005; Watson & Hewett, 2006), and furthermore plays a fundamental role in team and organization effectiveness (Argote et al., 2000, 2003; Cummings, 2004). Thus, we will focus on the transfer between individual employees, which we define as the process through which one employee receives knowledge from another. More specifically, we will focus on knowledge transfer between colleagues within work teams. Various researchers have examined knowledge transfer between individuals and have investigated a large variety of possible influencing factors (Faraj & Sproull, 2000; Oshri et al., 2008; Thomas-Hunt, Ogden, & Neale, 2003; Srivastava, Bartol, & Locke, 2006; Staples & Webster, 2008).

Following Argote and colleagues (2003) and Szulanski (1996), these predictors can be categorized into three sets of constructs: those that characterize the source and recipient of
knowledge, those pertaining to the relationship between source and recipient or the context in which knowledge transfer takes place (e.g., work context), and those that characterize the knowledge that is transferred.

Within the first category, characteristics of source and recipient of knowledge, especially motivation has been shown to be related to knowledge transfer, e.g., in terms of propensity to share, enjoyment or intrinsic benefit of sharing (Cross & Sproull, 2004; Jarvenpaa & Staples, 2000; Kankanhalli, Tan, & Wie, 2005; Wasko & Faraj, 2000), as well as in terms of organizational reward, extrinsic benefit, or reputation (Bock et al., 2005; Constant, Sproull, & Kiesler, 1996; Kankanhalli et al., 2005; Wasko & Faraj, 2000, 2005). Additionally, work-related attitudes (Cabrera, Collins, & Salgado, 2005; Constant et al., 1996; Gray & Meister, 2004; Jarvenpaa & Staples, 2001; Kankanhalli et al., 2005; Wasko & Faraj, 2000, 2005), skills (Reagans & McEvily, 2003; Watson & Hewett, 2006), characteristics like experience of source and recipient (Constant et al., 1996; Cross & Sproull, 2004; Gray & Meister, 2004; Wasko & Faraj, 2005; Watson & Hewett, 2006), and the source’s or recipient’s trustworthiness (Levin & Cross, 2004; Staples & Webster, 2008) have been linked to knowledge transfer. For many constructs, however, results from different studies are not consistent, especially across different knowledge transfer outcomes. For example, some authors looking at knowledge sharing found extrinsic rewards to have a positive effect (Constant et al., 1996; Kankanhalli et al., 2005; Wasko & Faraj, 2000, 2005), whereas another study examining the intention to share knowledge found a negative one (Bock et al., 2005), and researchers who studied transfer as such did not find any effect at all (Cabrera et al., 2005; Zárraga & Bonache, 2005). Taking tenure as another example, results have been very mixed; while Gray and Meister (2004) found that job tenure had a negative and organizational tenure a non-significant effect on knowledge seeking, Wasko and Faraj (2005) found a
positive effect of tenure in the field and Watson and Hewett (2006) of organizational tenure, both on contributing knowledge to repositories.

The majority of constructs in the second category refers to the group context: many studies have examined a culture or climate that is supportive of knowledge transfer (Bock et al., 2005; Goodman & Darr, 1998; Zárraga & Bonache, 2005), that relies on reciprocity (Kankanhalli et al., 2005; Wasko & Faraj, 2005), or that is characterized by social norms (Constant, Kiesler, & Sproull, 1994; Jarvenpaa & Staples, 2000; Quigley et al., 2007). Furthermore, it has been shown that transactive memory can support the transfer of knowledge (Jarvenpaa & Majchrzak, 2008; Oshri et al., 2008). In a similar manner, constructs that describe the workplace’s properties (Goodman & Darr, 1998; Watson & Hewett, 2006) or job characteristics (Gray & Meister, 2004; Jarvenpaa & Staples, 2000) have been demonstrated to influence knowledge transfer. In network research, effects on knowledge transfer have been shown for network-related characteristics, such as network centrality (Wasko & Faraj, 2005), or characteristics of the relationship between source and recipient, such as tie strength (Constant et al., 1996; Levin & Cross, 2004; Reagans & McEvily, 2003) and lesser formality of the relationship (Cross & Sproull, 2004).

Finally, constructs have been studied that refer to characteristics of the knowledge that is transferred, for example, tacitness (Levin & Cross, 2004) or codifiability (Reagans & McEvily, 2003).

In spite of this considerable amount of research, there is as yet no clear understanding of the underpinnings of knowledge transfer (Argote, 1999; Ko et al., 2005; van Wijk et al., 2008). Some of the results are, as exemplified for the first category of constructs, contradictory, some have simply not been replicated (with certain studies showing significant effects and others not), and predictors have yielded different degrees of importance in different studies. We suggest that such inconsistencies could be resolved if researchers pay
more attention to the distinctions a) between sharing and seeking knowledge and b) effects at the different levels of analysis. Both distinctions are further described in the following.

2.3.1. Differentiation between sharing and seeking knowledge

In communication theory, communication always takes place between a sender and a receiver (Lasswell, 1948; Shannon & Weaver, 1949; Watzlawick, Beavin, & Jackson, 1967). In a similar manner, in knowledge transfer, there is usually a source as well as a recipient (or seeker) of knowledge (Kankanhalli et al., 2005; Szulanski, 1996; Watson & Hewett, 2006). With knowledge sharing, we refer to a behavior by which an individual shares knowledge with another individual, regardless of the form of knowledge, the communication channel used, or the initiating party of the transfer. Similarly, following Gray and Meister (2004), we define knowledge seeking as a behavior by which an individual actively accesses another’s knowledge, regardless of the form of knowledge, or the communication channel. This distinction between sharing and seeking is not new. For example, van Wijk and colleagues (2008) demonstrated in their meta-analysis on team and organizational level predictors and outcomes of knowledge transfer that, depending on the direction of knowledge transfer investigated, the relationship between different predictors and knowledge transfer differs. Surprisingly though, studies that actually looked at sharing and seeking in juxtaposition and compared effects on these behaviors at lower levels of analysis are relatively rare. Furthermore, the studies that exist sometimes failed to compare influences of predictors on the two behaviors (Watson & Hewett, 2006). The one study that did compare effects on these two behaviors (Goodman & Darr, 1998) did not find remarkable differences. In most cases in the extant literature, nonetheless, researchers have either only focused on knowledge sharing (Constant et al., 1996; Kankanhalli et al., 2005; Wasko & Faraj, 2005; Quigley et al., 2007; Reagans & McEvily, 2003), or have looked at knowledge transfer as such, without
distinguishing between different transfer behaviors (Cabrera et al., 2005; Collins & Smith, 2006; Faraj & Sproull, 2000; Jarvenpaa & Staples, 2000; Zárraga & Bonache, 2005).

We therefore see the need to empirically establish the distinction between knowledge sharing and knowledge seeking within teams by investigating and comparing effects on these variables jointly. Although some results from the extant literature suggest that the two behaviors are stimulated by different situations and influenced by different predictors (Gray & Meister, 2004; Gupta & Govindarajan, 2000; van Wijk et al., 2008), empirical support that strengthens this distinction and establishes it for future research is missing.

2.3.2. **Multilevel analysis of predictors of knowledge transfer**

In her paper, Kostova (1999) argued that there is a theoretical necessity of multilevel analyses in transfer research. She based her arguments on Granovetter’s (1992) embeddedness perspective, suggesting that transfer does not occur in a social vacuum, but in a multifaceted context. Therefore, national, organizational, or relational contexts should be taken into account. Likewise, Szulanski (1996), studying knowledge transfer between units, argued that knowledge exchanges are embedded in an organizational context, and Foss and colleagues (2010) called for multilevel knowledge transfer research that simultaneously takes micro (individual) level and macro (organizational) level influences into account. Accordingly, it is important to ascertain variables’ contextual-level effect – separate from their individual-level effect. The distinction between levels of effect is necessary, because often, the same variable taps different or even more constructs at the group (i.e., aggregate) level than at the individual level, and different effects at the different levels result (Firebaugh, 1978). Consider, for example, employees who work together in a team (in this case their context and second level of analysis) and transfer knowledge within the team. Employees share their knowledge because they enjoy helping their colleagues (Kankanhalli et al., 2005). In addition to this
individual-level effect, the team composition with respect to the same construct (i.e., the team aggregate) which creates a certain context can also play a role. The fact that, on average, all members of a team enjoy sharing knowledge and helping one another might create a certain atmosphere that encourages the employees in this team to share more knowledge; and this regardless of their own motivation, i.e., even if they themselves don’t enjoy it very much, simply because “everybody does it”. Thus, at the team level, the connection between intrinsic motivation of employees and sharing knowledge would even be stronger, because the aggregated individual level effect (own motivation leads to sharing) and contextual effect (motivation of colleagues leads to sharing) add up.

Taking a multilevel approach and investigating effects at both levels separately is especially important as – unlike in our example – effects of the same construct do not necessarily work in the same direction at the different levels (Bliese, 1998; Chan, 1998; Firebaugh, 1978). Therefore, if predictors are analyzed in an aggregated way instead of with respect to their potentially differing influences at different levels, their effects might be overlooked (they may exist at one level only), or they might be misinterpreted (e.g., a contextual effect might be mistaken for an individual-level effect). Knowing about the exact level of effects is very important, also with respect to practical implications. Coming back to the example of intrinsic motivation, it would be important for organizations to know about the additional contextual-level effect of team members’ intrinsic motivation. Instead of trying to raise intrinsic motivation through extensive supervisor support or other costly means, organizations could encourage those employees who are not intrinsically motivated to share knowledge by teaming them up with employees who are. These arguments show that whenever possible and theoretically appropriate, a multilevel approach should be taken. So far, only very few studies on knowledge transfer analyzed the influences of independent
variables at different levels (Cross & Sproull, 2004; Quigley et al., 2007), and none of these studies compared influences of the same independent variable at different levels.

2.3.3. Hypotheses

Based on the framework of possible predictors presented in section 2.3., we chose the independent variables according to the following criteria: a) the predictors should represent the categories proposed by Argote and colleagues (2003) and Szulanski (1996), b) the predictors could theoretically have differential effects on sharing and seeking at the different levels of analysis, and c) the predictors had already been proposed and investigated.

According to van Wijk and colleagues (2008, p. 833), the list of characteristics of sources and receivers “that are and can be included in analyses is virtually endless”. Since this category is apparently very broad and frequently employed, we decided to choose two variables from this group: age as one of the most important demographic variables, and motivation as one of the most basic explanations of human behavior. First, age is one of the main demographic variables and has been studied as a predictor of many work-related outcomes, especially performance as such (McEvoy & Cascio, 1989; Ng & Feldman, 2008; Sturman, 2003; Waldman & Avolio, 1986). In the context of the aging workforce, it becomes ever more important to study effects of age on different organizational behaviors. The percentage of older employees in the workforce is increasing, and the baby boomer generation (those born between 1946 and 1966) is starting to retire, thus creating a threat of knowledge loss unless their valuable knowledge is retained. Therefore, it is important to know if older employees differ in their knowledge transfer behavior from younger employees, as well as to investigate how the change in the overall age of teams will influence knowledge transfer. Second, we chose motivation as an independent variable, since research has established intrinsic and extrinsic benefits as motivators of human behavior in several domains (Atkinson,
from the second category, constructs characterizing the context in which knowledge transfer occurs, we chose job autonomy due to the importance of the work context for knowledge transfer within teams. Job autonomy is one of the most prominent job characteristics (Hackman & Oldham, 1975), has been shown to impact a variety of job-related outcomes (Spector, 1986), and has been argued to promote knowledge creation (Nonaka, 1994).

To fulfill our research aim, predictors had to be interpretable at the individual as well as the contextual (i.e., aggregated) level, which in our case is the level of the work team. Age as well as motivation and job autonomy can be interpreted at the individual level, and, as an aggregate representing the team composition with respect to these variables, also at the team level. Additional predictors that describe the type of knowledge transferred (third category) were not included, as within the present framework, adding such a dimension would have called for a third type of distinction, e.g. between tacit and explicit knowledge (Nonaka, 1994), rather than introducing another predictor such as tacitness. In addition to the distinction between sharing and seeking and the distinction between effects at individual and team level, this would have rendered the study design extremely complex, which is why we kept to the two focal distinctions described.

Age. Age is not only an important predictor in the context of job performance, but also merits special attention when knowledge transfer is under examination. Many factors indicate that age is a promising predictor and furthermore affects sharing and seeking differently. Surprisingly, age has to date rather been used as a control variable (Gray & Meister, 2004; Kankanhalli et al., 2005; Watson & Hewett, 2006). We argue that older employees usually
have a great deal of work and life experience as well as expertise (which is the building block of knowledge; Alavi & Leidner, 2001), and these beyond their current job and organization. Therefore, older employees are destined to be sources of knowledge but less inclined to seek it, as they might not see the need to do so. Conversely, younger employees have not yet had time to gather an equal amount of knowledge and should therefore be the ones who seek more knowledge. This age effect originating from (life) experience should be strengthened by the stereotype that older employees per se have more knowledge than younger ones (Warr & Pennington, 1993), which should lead older employees to be sought out as sources of knowledge regardless of their actual knowledge. Furthermore, older adults in contrast to younger ones lay more importance on interpersonal relationships and show higher organizational citizenship behavior (OCB; Aryee & Chay, 2001; Ng & Feldman, 2008). Thus they are more inclined to help, answer questions or give advice than younger employees, which should increase their knowledge sharing. Similarly, generativity research proposes that older adults have a tendency to share with younger people, which is based on a concern to guide the next generation (Erikson, 1963). Summing up these arguments, we predict:

**HYPOTHESIS 1a:** Age is positively related to knowledge sharing at the individual level.

**HYPOTHESIS 1b:** Age is negatively related to knowledge seeking at the individual level.

With respect to the multilevel approach, it is important to notice here that these hypotheses describe mere individual level effects within groups – team mean differences are not taken into account. In other words, we are here considering if employees share more knowledge with their team colleagues when they are older than their team colleagues. This means that a 35-years old employee would share more in a team with a mean team age of 25 (where this employee would be older than others) than in a team with a mean team age of 45 (where the employee would be younger than others).
At the team level, age should play a very different role. By drawing on the same arguments, the contextual effect of team level age should have opposite effects in comparison to the individual level. While at the individual level, older employees should share more knowledge, higher team mean age implies that team colleagues are on average older (than in other teams) and have a great deal of experience and knowledge. Consequently, there is less need for single employees in an older team to share their knowledge than in a team that is on average relatively young. This should affect employees’ knowledge transfer regardless of their own age, i.e., constitute a contextual effect. Again, this effect should be strengthened by age stereotypes (Warr & Pennington, 1993); employees in older teams might assume that their colleagues are already very knowledgeable and, therefore, they might share less with them. Furthermore, generativity (Erikson, 1963) should strengthen knowledge sharing with colleagues in a younger, but not in an older team. Therefore, we predict:

**HYPOTHESIS 1c:** Average team age (i.e., age at the team level) is negatively related to knowledge sharing.

Along the same lines, we suggest that, when team colleagues are on average older and have a lot of experience, it is more worthwhile seeking their knowledge than when colleagues are younger. Moreover, as older employees are higher in OCB, the probability that colleagues would be willing to help would be higher in older teams, and, at least for younger employees in older teams, generativity would also improve chances of being received well when seeking knowledge. Therefore, individual employees in older teams should seek more knowledge than employees in younger teams (i.e., there should be a positive contextual effect) – again, regardless of employees’ own age. As argued before, stereotypes about age and knowledge should strengthen these effects. Therefore, we predict:

**HYPOTHESIS 1d:** Average team age (i.e., age at the team level) is positively related to knowledge seeking.
Figure 2. Simplified relationships between age and knowledge sharing, and age and knowledge seeking at the individual and team level. For knowledge sharing and age, a perfect positive relationship at the individual level and a perfect negative relationship at the team level are depicted. For knowledge seeking and age, a perfect negative relationship at the individual and a perfect positive relationship at the team level are depicted.

As this distinction between individual and team level effects is still unusual and a little counterintuitive, especially when effects with different directions are assumed, the proposed effects of age on sharing and seeking are depicted in a simplified manner in Figure 2a and 2b, respectively. Similar representations for separate individual level and team level effects can, for example, be found in Raudenbush and Bryk (2002) or Enders and Tofighi (2007).

These different hypotheses for the influence of age on sharing and seeking might seem contradictory, but it should be kept in mind that sharing and seeking within teams are related, but that not every instance of sharing has been preceded by knowledge seeking (and not necessarily every seeking request will lead to knowledge sharing). Thus, it is possible that in an on average older team, more knowledge than in other teams is sought, but less is shared.

Motivation. According to Maurer and Tarulli (1994), perceived intrinsic outcomes consist of incentives such as more interesting and stimulating work content, whereas extrinsic outcomes
consist of more tangible incentives such as better pay or promotion. Osterloh and Frey (2000) argued that depending on the organizational form and type of knowledge to be transferred, either intrinsic or extrinsic motivation can better enable knowledge transfer. We furthermore argue that, depending on the knowledge transfer behavior under study, intrinsic and extrinsic motivation play different roles.

If we consider the knowledge source, the trigger for knowledge sharing is either a colleague who approaches the source with a certain problem or question or an encountered piece of knowledge that the source deems helpful for a colleague. The source, for whom the transfer is costly, now has the choice to share knowledge or to keep it. Studies have shown that intrinsic motivation, e.g., enjoying to help others (Kankanhalli et al., 2005; Wasko & Faraj, 2000), has a good chance of tipping the scale towards sharing. On the other hand, results for extrinsic benefits are – as we have reported earlier – very inconclusive. Therefore, the only effect of motivation on individual-level sharing we predict is the following:

**Hypothesis 2a:** Intrinsic motivation is positively related to knowledge sharing at the individual level.

Conversely, for the knowledge seeker, the situational trigger is very different. In most cases, the seeker will act out of a necessity, and the decision to seek knowledge from a colleague will depend more on the probability of successfully acquiring helpful knowledge and on the value of this knowledge with respect to solving a problem, than it will depend on intrinsic benefits. For example, Wasko and Faraj (2000) asked users why they were part of a newsgroup, and 21.5% answered that they participated to generate tangible results. Therefore, we predict:

**Hypothesis 2b:** Extrinsic motivation is positively related to knowledge seeking at the individual level.
Again, both hypotheses 2a and 2b describe mere individual level effects within groups. At the team level, intrinsic motivation should encourage both behaviors. Being surrounded by a team that, in comparison to other teams, highly enjoys knowledge transfer should constitute a more positive climate for transfer and thereby encourage individual team members to share more knowledge, regardless of their own motivation. Furthermore, working in such a team should encourage single employees to seek more knowledge as their team members enjoy helping them, thereby reinforcing seeking behavior. Therefore, we predict:

HYPOTHESIS 2c: Team mean intrinsic motivation (i.e., intrinsic motivation at the team level) is positively related to knowledge sharing and knowledge seeking.

With respect to extrinsic motivation, we propose no such contextual effect; if members of a team primarily transfer knowledge for extrinsic rewards, they are motivated to transfer only if there are rewards inherent in the transfer situation. Consequently, there is no general positive climate for transfer as in the case of intrinsic motivation.

Job Autonomy. Job autonomy is “the degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling the work and in determining the procedures to be used in carrying it out” (Hackman & Oldham, 1975, p. 162). Several findings indicate that job autonomy is related to knowledge transfer, especially to knowledge sharing. Knowledge sharing is very costly for the knowledge source in terms of time, effort, and energy (Constant et al., 1996; Goodman & Darr, 1998; Reagans & McEvily, 2003; Szulanski, 1996). To be able to share knowledge during working hours, employees must have a certain degree of freedom in deciding when and how they do their work, which gives them the opportunity to make time and spend energy on knowledge sharing. Furthermore, job autonomy has been shown to be related to creativity and innovation (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Paolillo & Brown, 1978). Accordingly, employees who have greater job autonomy are thought to develop more ideas and create more knowledge than
others (Nonaka, 1994). Consequently, they have more or different knowledge than their team members, and should therefore be sought out more often as sources of knowledge. Therefore, we predict:

**HYPOTHESIS 3a: Job autonomy is positively related to knowledge sharing at the individual level.**

As we argued before, the knowledge seeker will seek more knowledge from colleagues when the chances are high that this behavior will yield positive results. An increase in job autonomy might increase the number of knowledge seeking opportunities, since it gives the seeker more freedom to do so, but it does not necessarily increase the frequency of actual knowledge seeking. The decision to ask colleagues for knowledge also depends on the probability of receiving a helpful answer. According to Borgatti and Cross (2003), one of the main influences on seeking information from another person is timely access to that person’s thinking. And if the seeker’s colleagues can provides access to their knowledge is, as argued above, at least partly dependent on their job autonomy. Consequently, the seeker is encouraged to ask team members for advice if these have, on average, greater job autonomy, and not necessarily if the seeker’s own job autonomy is high. Therefore, we predict:

**HYPOTHESIS 3b: Team mean job autonomy (i.e., job autonomy at the team level) is positively related to knowledge seeking.**

### 2.4. Method

#### 2.4.1. Sample and data collection

The study was conducted at two mid-sized German companies, an automobile manufacturer and a financial service provider. Survey data were collected from 68 teams with a total number of N=572 employees. To avoid biased team-level estimations due to non-response, one team with only one participant was excluded from the study (Timmerman, 2005), leaving
a final sample of 67 teams and N=571 individuals. The sample is composed of 15% blue and 85% white collar workers with a mean age of 39.87 years (SD=8.21) and a mean experience in their present job of 9.15 years (SD=7.89). Teams were permanent work teams with a mean size of 8.52 members (SD=3.72). Appointments were scheduled with single work teams at the respective companies, and research assistants administered the paper-pencil questionnaires. Participation was voluntary.

2.4.2. Measures

As the study was conducted in German, scales stemming from the English-speaking literature were translated into German, then independently back-translated into English and compared to the original version. Where there were inconsistencies, they were resolved by the translators (a procedure recommended by Brislin, 1980). Items for intrinsic and extrinsic motivation, job autonomy, knowledge sharing and knowledge seeking, and climate supporting innovativeness can be found in the appendix.

Independent variables. Age was collected via birth date. For mean team age, individual age was aggregated to the team level, showing an intraclass correlation coefficient ICC(1) of 0.15, implying that there is enough between-group variance to have a meaningful influence at the team level.

Intrinsic motivation and extrinsic motivation were each measured with a three-item scale based on Cabrera and colleagues (2005), who derived their scale from Maurer and Tarulli (1994). These different authors used the scale to predict knowledge sharing and other behaviors in the work context, respectively. We chose this scale as it captures the two types of motivations in our focus in a very parsimonious way. Items measured the perceived intrinsic and extrinsic outcome or benefit of knowledge transfer (e.g., “I find it rewarding when others use my ideas and experiences.”). They were rated on a four-point Likert scale from “strongly
disagree” to “strongly agree”. In the process of translating and adapting the scales to the context of the present study, one of the items for intrinsic motivation had to be dropped. Cronbach’s alpha for intrinsic motivation from the two remaining items was 0.66 and for extrinsic motivation, based on three items, 0.67. For team mean intrinsic motivation, individual ratings were aggregated to the team level (ICC(1) = 0.08).

Job autonomy was measured with four items developed by Thomson and Prottas (2005). This scale was chosen with respect to our sample of employees. The items from this scale describe a reasonable degree of autonomy, for example, “I decide when I take breaks.” Items were rated on a four-point Likert scale ranging from “strongly disagree” to “strongly agree”, and Cronbach’s alpha was 0.69. For team mean job autonomy, individual ratings were aggregated to the team level (ICC(1) = 0.22).

Dependent variables. In accordance with previous measurements of knowledge transfer as a frequency (Cummings, 2004; Kankanhalli et al., 2005), we measured knowledge sharing and knowledge seeking with two items each, asking participants how often they had recently shared or sought a) factual knowledge and b) experience with / from their colleagues within the team. Ratings were given on a six-point Likert scale ranging from “never” to “very often”. Cronbach’s alpha for both knowledge sharing and knowledge seeking was 0.86. ICC(1), as a measure of non-independence (Bliese, 2000), amounted to 0.04 for knowledge sharing and 0.10 for knowledge seeking, showing that the dependent variables were influenced to a certain degree by group membership, were therefore non-independent and needed to be analyzed by means of a multilevel approach.

Control variables. To rule out alternative explanations, we included several control variables in our analyses. Effects of independent variables were controlled for a company dummy, blue collar versus white collar work, part-time versus full-time employment, years of job experience in the current position, and a climate supporting innovativeness. The latter was
done to account for possible differences between contexts in different business units and the two organizations. The climate supporting innovativeness was measured with three items (e.g., “My team encourages suggesting ideas for new opportunities.”) on a five-point Likert scale ranging from “strongly disagree” to “strongly agree” (Bock et al., 2005). Individual ratings of the climate supporting innovativeness were aggregated to the team level, with a mean $r_{WG(J)}$ of 0.75 (Cohen, Doveh, & Eick, 2001; James, Demaree, & Wolf, 1984), an ICC(1) of 0.21 and ICC(2) of 0.69 (Shrout & Fleiss, 1979; McGraw & Wong, 1996), showing that there is sufficient agreement between team member ratings to justify aggregation.

2.4.3. Analytic strategy and statistical approach

We first conducted a missing variable analysis and found that missing data did not amount to more than 5% in any of the variables. Monte Carlo studies have shown that with such a small percentage of missing data, employing the expectation-maximization (EM) algorithm to replace them produces less bias than listwise (Graham & Donaldson, 1993; Malhotra, 1987; Muthen, Kaplan, & Hollis, 1987) or pairwise deletion (Muthen et al., 1987). Therefore, missing data were filled using EM statistics (Dempster, Laird, & Rubin, 1977). The EM algorithm is an iterative process with two steps for each iteration; the first step computes expected values based on observed data and estimates from the last iteration, the second step provides maximum-likelihood estimates of the parameters in question based on values from the first step. We then computed simple descriptives and zero-order correlations, conducted ANOVAs to compute ICC(1)s, and calculated the $r_{WG(J)}$.

To test our hypotheses, we had to take into account that subjects who originate from different teams within an organization, as in the present sample, are nested within teams and data are therefore non-independent (Bliese, 1998; Hoffman, 1997; Hox, 2002; Raudenbush & Bryk, 2002). If non-independence is not accounted for, standard errors are too small and
results from regression-based statistics are biased. Consequently, we used multilevel modeling to test our hypotheses, employing the HLM 6.06 statistical package. Since we wanted to demonstrate that influences of predictors differ with regard to sharing and seeking, we needed to directly compare these influences. Thus, we used multivariate multilevel modeling techniques. These techniques allow for more than one dependent variable by adding another level to the model (the outcome level in addition to the person and team level). This additional level only contains the two dependent variables. Thereby, we could create a model with both, sharing and seeking, as dependent variables instead of analyzing two separate models. This allowed us to directly compare the coefficients for influences on the two transfer behaviors (Hox, 2002).

For the hypotheses tests, we built two such multivariate multilevel models in the following manner: In a first step, we entered the control variables at the individual level, centered around their group mean, and at the team level, centered around their grand mean (Model 1). These and other centering decisions were based on recommendations by Enders and Tofighi (2007). In a second step, we entered age, intrinsic and extrinsic motivation, and job autonomy at the individual level, again centered around their group mean, and team mean intrinsic motivation, team mean age and team mean job autonomy at the team level, centered around the grand mean (Model 2).

In order to check if the two multilevel models calculated could account for variance in the dependent variables, goodness of fit equivalent to the $R^2$ in regression statistics was calculated following a procedure suggested by Bryk and Raudenbush (2002). First, a one-way ANOVA model was computed in HLM with knowledge sharing and knowledge seeking as dependent variables. The resulting values for $\sigma^2$ (within-group variance) and $\tau_{00}$ (between-group variance) from this baseline model were then compared with $\sigma^2$ and $\tau_{00}$ values from subsequent models in the following manner:
When individual-level predictors were added

\[ R^2 = \frac{\bar{\sigma}^2(\text{baseline model}) - \bar{\sigma}^2(\text{extended model})}{\bar{\sigma}^2(\text{baseline model})}, \]

(1)

and when team-level predictors were added

\[ R^2 = \frac{\bar{\tau}_{oo}(\text{baseline model}) - \bar{\tau}_{ao}(\text{extended model})}{\bar{\tau}_{oo}(\text{baseline model})}. \]

(2)

In order to test our general propositions that influences on sharing and seeking differ as well as influences at the individual and team level, we defined contrasts for the respective coefficients in HLM (Enders & Tofighi, 2007; Hox, 2002). A contrast is a composite hypothesis on a set of parameters that postulates, for example, that parameters are equal. Contrasts are tested, automatically within HLM 6.06, with an asymptotic chi-square test (Hox, 2002; Raudenbush & Bryk, 2002; Tabachnick & Fidell, 2001). To ascertain if individual age has the same association with both sharing and seeking, we tested the null hypothesis represented by the contrast \(1^*\) coefficient for individual-level age (sharing) + (-1)* coefficient for individual-level age (seeking) = 0. Likewise, to determine if age has the same association with sharing at the individual and team level, the null hypothesis represented by the contrast \(1^*\) coefficient for individual-level age (sharing) + (-1)* coefficient for team-level age (sharing) = 0.

2.5. Results

2.5.1. Descriptive statistics

Table 1 depicts the descriptive statistics, ICC(1)s, reliability coefficients, and zero-order correlations. However, estimations in this correlation matrix should be interpreted with caution, since they only depict individual level zero-order correlations and do not take the non-independence of the data into account.
### Table 1

Descriptive Statistics and Individual Level Zero-Order Correlations

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>ICC(1)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>39.87</td>
<td>8.21</td>
<td>0.15</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Intrinsic Motivation</td>
<td>3.46</td>
<td>0.49</td>
<td>0.08</td>
<td>-.16**</td>
<td>.66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Extrinsic Motivation</td>
<td>2.54</td>
<td>0.62</td>
<td>0.03</td>
<td>-.14**</td>
<td>.29***</td>
<td>.67</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Job Autonomy</td>
<td>2.69</td>
<td>0.61</td>
<td>0.22</td>
<td>-.09*</td>
<td>.19***</td>
<td>.17***</td>
<td>.69</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Experience</td>
<td>9.15</td>
<td>7.89</td>
<td>0.29</td>
<td>-.53***</td>
<td>-.18***</td>
<td>-.15***</td>
<td>-.15***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. White collara</td>
<td>1.85</td>
<td>0.35</td>
<td>-</td>
<td>-.18***</td>
<td>.20***</td>
<td>.15***</td>
<td>.25***</td>
<td>-.39***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Full-timeb</td>
<td>1.91</td>
<td>0.28</td>
<td>-</td>
<td>-.05</td>
<td>-.07†</td>
<td>.08†</td>
<td>.08†</td>
<td>-.01</td>
<td>-.11**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Company dummy</td>
<td>0.39</td>
<td>0.49</td>
<td>-</td>
<td>-.23***</td>
<td>.20***</td>
<td>-.03</td>
<td>.11**</td>
<td>-.14**</td>
<td>.34***</td>
<td>-.30***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Climate Innovativeness</td>
<td>3.32</td>
<td>0.83</td>
<td>0.21</td>
<td>-.13**</td>
<td>.23***</td>
<td>.21***</td>
<td>.38***</td>
<td>-.15**</td>
<td>.14**</td>
<td>.03</td>
<td>.17***</td>
<td>.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Knowledge Sharing</td>
<td>4.39</td>
<td>0.95</td>
<td>0.04</td>
<td>.05</td>
<td>.23***</td>
<td>.13**</td>
<td>.21***</td>
<td>-.01</td>
<td>.09*</td>
<td>.12**</td>
<td>.01</td>
<td>.25***</td>
<td>.86</td>
<td></td>
</tr>
<tr>
<td>11. Knowledge Seeking</td>
<td>3.89</td>
<td>1.06</td>
<td>0.10</td>
<td>-.33***</td>
<td>.23***</td>
<td>.29***</td>
<td>.13**</td>
<td>-.37***</td>
<td>.24***</td>
<td>.07†</td>
<td>.05</td>
<td>.24***</td>
<td>.27***</td>
<td>.86</td>
</tr>
</tbody>
</table>

**Note.** N=571. Cronbach’s alphas in the diagonal.

* White collar coded as 1 = blue collar worker, 2 = white collar worker.  
* Full-time coded as 1 = part-time employment, 2 = full-time employment.

† *p < .10.  
* p < .05.  
** p < .01.  
***p < .001.
2.5.1. **Hierarchical linear modeling**

The results of the hypotheses tests are given in Table 2. Model 1 presents the relationships of the control variables with knowledge sharing and seeking. Model 2 additionally depicts the relationships of the independent variables with knowledge sharing and seeking.

As shown in Model 1, the control variables experience, full-time employment, and the climate supporting innovativeness were positively, and team mean experience negatively related to knowledge sharing. Knowledge seeking, on the other hand, was negatively related to experience and team mean experience, and positively related to white collar work as well as full-time employment. Model 1 explained 3.7% of the within-group and 59.7% of the between-group variance in knowledge sharing, and 10.9% of the within-group and 55.3% of the between-group variance in knowledge seeking.

Results of the hypotheses tests are shown in Model 2. Hypotheses 1a and 1b are fully supported, as individual age was positively related to knowledge sharing ($\gamma = 0.01, p = 0.03$) and negatively related to knowledge seeking ($\gamma = -0.02, p = 0.01$). Hypotheses 1c and 1d predicted that average team age has a negative effect on knowledge sharing and a positive effect on knowledge seeking. Results shown in Model 2 demonstrate that there was no significant relationship between average team age and knowledge sharing, but, contrary to predictions, there was a negative relationship between team age and knowledge seeking. Nevertheless, according to the results from contrast analysis (Table 3), individual- and team-level coefficients of age did not differ, either for sharing ($\chi^2 = 0.01, p > 0.5$) or for seeking ($\chi^2 = 2.09, p = 0.15$). This suggests that the significant team-level coefficient for seeking is due to the individual-level relationship and does not constitute a true contextual effect. Therefore, Hypotheses 1c and 1d could not be supported. However, the contrasts between the coefficients of age for knowledge sharing and seeking revealed that the influence of age on
Table 2
Hierarchical Linear Models for Knowledge Sharing and Knowledge Seeking

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>y (SE)</td>
<td>y (SE)</td>
</tr>
<tr>
<td></td>
<td>Sharing</td>
<td>Seeking</td>
</tr>
<tr>
<td>Individual Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>0.013*</td>
<td>-0.048***</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>White collar a</td>
<td>0.206</td>
<td>0.809*</td>
</tr>
<tr>
<td></td>
<td>(0.365)</td>
<td>(0.378)</td>
</tr>
<tr>
<td>Full-time b</td>
<td>0.677***</td>
<td>0.337*</td>
</tr>
<tr>
<td></td>
<td>(0.165)</td>
<td>(0.171)</td>
</tr>
<tr>
<td>Age</td>
<td>0.013*</td>
<td>-0.017**</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>0.366***</td>
<td>0.19*</td>
</tr>
<tr>
<td></td>
<td>(0.088)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Extrinsic Motivation</td>
<td>0.066</td>
<td>0.34***</td>
</tr>
<tr>
<td></td>
<td>(0.067)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Job Autonomy</td>
<td>0.323***</td>
<td>-0.020</td>
</tr>
<tr>
<td></td>
<td>(0.074)</td>
<td>(0.077)</td>
</tr>
<tr>
<td>Team level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company Dummy</td>
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<td>-0.047</td>
</tr>
<tr>
<td></td>
<td>(0.089)</td>
<td>(0.106)</td>
</tr>
<tr>
<td>Experience</td>
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<td>-0.050***</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.011)</td>
</tr>
<tr>
<td>Climate Innovativeness</td>
<td>0.199*</td>
<td>0.116</td>
</tr>
<tr>
<td></td>
<td>(0.098)</td>
<td>(0.115)</td>
</tr>
<tr>
<td>Age</td>
<td>0.015</td>
<td>-0.041*</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>0.406†</td>
<td>0.580*</td>
</tr>
<tr>
<td></td>
<td>(0.234)</td>
<td>(0.256)</td>
</tr>
<tr>
<td>Job Autonomy</td>
<td>-0.177</td>
<td>0.476*</td>
</tr>
<tr>
<td></td>
<td>(0.163)</td>
<td>(0.180)</td>
</tr>
</tbody>
</table>

Note. Variables at individual level group-mean centered, variables at team level grand-mean centered.

aWhite collar coded as 1 = blue collar worker, 2 = white collar worker. b Full-time coded as 1 = part-time employment, 2 = full-time employment.

† p < .10.  * p < .05.  ** p < .01.  *** p < .001.
knowledge sharing significantly differs from its influence on knowledge seeking at the individual ($\chi^2 = 16.53, p = 0.00$) as well as at the team level ($\chi^2 = 9.15, p = 0.00$).

Results for Hypotheses 2a to 2c are again shown in Model 2, Table 2, and the results of the respective contrast analyses again in Table 3. These hypotheses posited positive effects of individual intrinsic motivation on knowledge sharing, of individual extrinsic motivation on knowledge seeking, and of team mean intrinsic motivation on both knowledge transfer behaviors. Hypothesis 2a is supported by the results, as individual intrinsic motivation was positively related to knowledge sharing ($\gamma = 0.37, p = 0.00$). Unexpectedly, there was also a positive effect on knowledge seeking ($\gamma = 0.19, p = 0.04$). Furthermore, contrast analysis revealed that the coefficients for the effects of intrinsic motivation on sharing and on seeking did not differ ($\chi^2 = 2.63, p = 0.10$), suggesting that intrinsic motivation influences both behaviors in a similar way. Hypothesis 2b received full support as extrinsic motivation showed a positive relationship with knowledge seeking. Furthermore, contrast analysis demonstrated that the coefficient for the relationship with knowledge seeking differed significantly from the one for the relationship with knowledge sharing ($\chi^2 = 10.86, p = 0.00$). Hypothesis 2c, which predicted a positive effect of team mean intrinsic motivation on knowledge sharing and on knowledge seeking, did not receive support from the results. Although there was a positive effect on knowledge seeking ($\gamma = 0.58, p = 0.03$), there was only a marginally significant positive relationship with knowledge sharing ($\gamma = 0.41, p = 0.09$), and contrast analyses revealed that these were not true contextual effects; for both transfer behaviors, the coefficients for the relationship with individual intrinsic motivation did not differ significantly from the coefficients for the relationship with team mean intrinsic motivation (sharing: $\chi^2 = 0.03, p > 0.5$; seeking: $\chi^2 = 2.04, p = 0.15$).

According to Hypothesis 3a, a positive effect of job autonomy on knowledge sharing was expected, which was supported by the results (see Table 2; $\gamma = 0.32, p = 0.00$). Finally,
Hypothesis 3b, which stated that team mean job autonomy positively influences knowledge seeking, was also supported by the results ($\gamma = 0.48, p = 0.01$). Furthermore, the contrast analyses underline the differential influence of job autonomy: as would be expected from the hypotheses, the coefficients for the relationship with sharing significantly differed from the coefficient for the relationship with seeking, and this at the individual level ($\chi^2 = 14.36, p = 0.00$) and at the team level ($\chi^2 = 9.10, p = 0.00$). Similarly, the contrasts testing if coefficients for the relationship between the respective transfer behavior and job autonomy at the individual level differed from the coefficients for the same relationship at the team level yielded significant differences for both sharing ($\chi^2 = 7.83, p = 0.01$) and seeking ($\chi^2 = 6.41, p = 0.01$).

### Table 3

**Chi-Square Tests for Contrasts between Coefficients from Model 2 of the Hierarchical Linear Models**

| Individual vs. Team Level | Sharing | Seeking | | Individual Level | | Team Level |
|---------------------------|---------|---------|---------|------------------|------------------|
| Age                       | 0.01    | 2.09    | 2.04    | 6.41*            |
| Intrinsic Motivation      | 0.03    | 2.04    | 2.04    | 6.41*            |
| Job Autonomy              | 7.83**  | 2.04    | 2.04    | 6.41*            |
| Age                       |         | 16.53***| 9.15**  |                   |
| Intrinsic Motivation      |         | 2.63    | 0.32    |                   |
| Job Autonomy              |         | 10.86** | 9.10**  |                   |

† $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$. 
On examining the goodness of fit for the HLM analyses, Model 2, which incorporated control and independent variables, explained 12.7% of the within-group and 55.4% of the between-group variance in knowledge sharing (a decrease in explained variance, as in this case regarding between-group variance, is not uncommon; Raudenbush & Bryk, 2002), and 18.7% of the within-group and 75.0% of the between-group variance in knowledge seeking.

2.6. Discussion

The results of the present study show that employees share knowledge more frequently with their team members when they have a stronger intrinsic motivation, are older, and have higher job autonomy than their team members, whereas employees seek knowledge more frequently from their team members when they have a stronger extrinsic motivation and are younger than their colleagues, and work in a team that is characterized by higher job autonomy than other teams. Furthermore, the results show that employees seek more knowledge when they have a stronger intrinsic motivation.

2.6.1. Age

We found that employees who are older than their colleagues shared more knowledge within the team, and that employees younger than their colleagues sought more knowledge within the team. In other words, we found age to have a positive effect on sharing and a negative effect on seeking knowledge. It is noteworthy that these age effects were independent of experience with the current job, and can, therefore, not be interpreted as the effects of differences in job knowledge. Interestingly, when age was used as a control variable in previous literature, it did not show any effects – either on knowledge sharing (Kankanhalli et al., 2005; Watson & Hewett, 2006) or on knowledge seeking (Gray & Meister, 2004). Whether these non-significant findings might be based on age biases in the sample or on
selection effects, we cannot determine. Future research might look into this issue more precisely, since with the aging workforce it will be important to be aware of differences between different age groups’ knowledge transfer behaviors.

Contrary to our expectations, we did not find contextual age effects (independent of individual age) on the two transfer behaviors. There are at least two possible explanations for the lack of an effect here: either the age of colleagues simply does not influence individual sharing and seeking behavior, or, as we suggest, the differences in age between teams were not perceived as meaningful. That is, although there were teams that were statistically older than other teams, employees in these teams did not perceive their colleagues to be older. Accordingly, they did not assume that their colleagues had less need for knowledge (and, therefore, the employees in these teams did not share less), and furthermore did not assume that their colleagues could provide them with more knowledge (and, therefore, these employees did not seek more). In the future, it might be interesting to investigate this issue in a sample with a greater between-group variance in age.

2.6.2. Motivation

The observation that motivation – in the form of intrinsic and extrinsic benefits – constitutes a main influence for individual knowledge transfer within teams has already been made in the literature (Constant et al., 1996; Gray & Meister, 2004; Jarvenpaa & Staples, 2000; Kankanhalli et al., 2005). Especially intrinsic benefits seem to be a strong motivating factor for any kind of knowledge transfer behavior. In the present study, and in line with the extant literature (Bock et al., 2005; Kankanhalli et al., 2005; Wasko & Faraj, 2000), intrinsic motivation proved to affect knowledge sharing in a positive way. However, contrary to our expectations, it also significantly affected knowledge seeking. Although they did not investigate intrinsic benefits of seeking, Gray and Meister (2004) encountered a similar result;
they found that an intrinsic motivation to learn predicted higher levels of knowledge seeking. We extended these findings by demonstrating that intrinsic benefits expected from knowledge transfer, too, have an effect on the frequency of seeking behavior, and that intrinsic motivation has an equal influence on both transfer behaviors.

The influence of extrinsic benefits on knowledge transfer has been, as reported earlier, an issue of ongoing debate in the extant literature, which might be due to the mixture of knowledge transfer behaviors considered. In the present study, we demonstrate that extrinsic benefits have a strong positive effect on seeking knowledge, whereas they have no significant effect on knowledge sharing. However, since some of the studies that found positive effects exclusively dealt with knowledge sharing (and not seeking) in IT settings (Constant et al., 1996; Kankanhalli et al., 2005), this may only be one part of the story. If we consider knowledge seeking, the effect of extrinsic benefits seems rather obvious: extrinsic benefits are direct and, at least partly, lie in the knowledge that the seeker receives. Wasko and Faraj (2000), for example, discovered in their qualitative study that people participate in newsgroups mainly for the extrinsic benefits they expect to gain from this participation (access to work-relevant knowledge that is only available there, solving problems, etc.). On the other hand, for knowledge sharing, extrinsic benefits can only be expected if the transfer is visible, especially for supervisors, and can be rewarded accordingly. This applies far more to IT settings (e.g., contributing to an electronic knowledge repository), than for within-team knowledge transfer which occurs between colleagues. This difference might explain why sharing is sometimes affected by extrinsic benefits, and sometimes it is not. This question certainly merits further investigation, for which making a distinction between sharing and seeking knowledge seems to be worthwhile.

Over and above these individual-level effects of motivation, we did not find a contextual effect of intrinsic motivation. Consequently, we have to assume that, again, it is rather the
employee’s own motivation that is decisive for the frequency of knowledge transfer behavior, and that the motivation of team members does not have an effect over and above the individual-level one.

2.6.3. Job autonomy

Our results demonstrated that job autonomy influences knowledge transfer behaviors in a different manner, depending on the behavior and level investigated. Therefore, it is not surprising that so far, job autonomy has had no reported effects on knowledge transfer (e.g., Cabrera et al., 2005, did not find an effect of individual-level job autonomy on knowledge transfer); effects are blurred as soon as these distinctions are not made. Several authors demonstrated that greater job autonomy leads to higher creativity and innovation (Amabile et al., 1996; Paolillo & Brown, 1978), which should be related to more knowledge creation. We have shown that, in addition, job autonomy enables the dissemination of such knowledge within the team. At the team level though, this effect disappears. When the members of a team had, on average, greater autonomy than employees in other teams, this did not improve knowledge sharing within their team. The effects of job autonomy on knowledge seeking mirrored these results. Although it did not make a difference if the individual employee had higher or lower job autonomy, knowledge seeking was far more frequent if the other team members had higher job autonomy. In other words, with respect to knowledge seeking, we only found a team-level effect. Our results suggest that the decisive factor for knowledge transfer to take place is the job autonomy of the source (in terms of knowledge sharing), or the possible sources (in terms of knowledge seeking), and not the job autonomy of the receiver or seeker.
2.6.4. Differentiation between knowledge seeking and knowledge sharing

Furthermore, the results have clearly shown that sharing and seeking knowledge are two distinct behaviors that are influenced differently by certain predictors. First of all, the coefficient for the correlation between knowledge sharing and knowledge seeking in the present study (zero-order correlation \( r = 0.27, r = 0.25 \) according to HLM) is comparable to results of previous research (e.g., Watson & Hewett, 2006; \( r = 0.20 \)). Coefficients from both these studies demonstrate that knowledge sharing and knowledge seeking are related, yet distinct constructs. Second, results from contrast analyses have demonstrated that the effects of all predictors (with the exception of intrinsic motivation) on knowledge sharing differ from the effects on knowledge seeking, at the individual as well as at the team level. Thus, the results clearly have shown the importance of the proposed distinction between knowledge sharing and seeking.

When researchers only focus on knowledge sharing, they neglect influences that are beneficial for knowledge seeking and are necessary for knowledge transfer as a whole. The same is true when the focus lies solely on knowledge seeking. Likewise, looking at knowledge transfer without separating the different transfer behaviors can also lead to the neglect of important influences, or to inconclusive results as in the case of extrinsic benefits or job autonomy. To explain why and when knowledge transfer takes place, researchers have to demonstrate what influences the transfer behaviors that form knowledge transfer. Only when it is clear what exactly affects these separate behaviors, knowledge transfer can be studied as a whole, and the different behaviors’ interactions that lead to successful knowledge transfer can be examined.
2.6.5. Differentiation between individual and team level

Moreover, the results of the present study have shown that it is important to analyze relationships at the individual and team level separately. Although we did not find support for the proposed team-level effects of age and intrinsic motivation, job autonomy did have differential effects at the individual and team level. If we had not analyzed these two levels separately, we would have found much weaker effects or none at all. Result would have shown a blend between a non-significant individual-level and a significant team-level affect in the case of knowledge seeking, and a significant individual-level and a non-significant team-level effect in the case of knowledge sharing. Furthermore, if we had found an effect, we would not have known whether the effect was due to individual or team influences, and could possibly have come to the wrong conclusions. Consequently, when the sample is structured by work groups or teams as in our case, and especially when the extant literature yields mixed or inconclusive results regarding a predictor, it is worthwhile introducing independent variables at the individual and team level of analysis.

2.6.6. Practical implications

For practitioners who try to create the most conducive environment for knowledge transfer, the current findings (including results regarding the control variables) have important implications in terms of job design, leadership, and team composition. There are two important practical implications that we want to stress:

First, when thinking about knowledge transfer, it is important to not only have knowledge sharing and the potential sources of knowledge in mind, but also knowledge seeking and the potential knowledge receivers. Our results as well as other examples in the literature (Gupta & Govindarajan, 2000) point out that influencing factors can have differing importance for sharing and seeking knowledge. If conditions are perfected, for example, for knowledge
sharing alone, this does not necessarily lead to successful knowledge transfer. Second, our findings underline that practitioners should always keep in mind that when employees are working in teams or work groups, individual knowledge transfer behavior is not just influenced by individual factors, such as the employees’ respective age or motivation, but also by the composition of their team, i.e., by the distribution of different factors throughout the team.

According to our results, there are different measures practitioners can take to encourage knowledge sharing and knowledge seeking within their teams. For example, we demonstrated that although knowledge sharing behavior is partly influenced by factors that are difficult or impossible to change, for example, employee age or intrinsic motivation, there are several conducive factors that are within their control: employing more employees full-time, giving employees more freedom to decide how they structure their work and when to do it, and creating an atmosphere that values suggesting ideas, finding new methods, and taking risks. Research on leadership (Ostroff, Kinicki, & Tamkins, 2003) has shown that team leaders play an important role in influencing the climate and atmosphere within teams. On the other hand, our results suggest that, to increase knowledge seeking, managers should stress the extrinsic benefits that lie in gaining knowledge from others (e.g., as an easy and fast way to solve problems, Constant et al., 1996) or, if possible, to set extrinsic rewards (e.g., financial benefits or other bonuses) for knowledge seeking. As already noted above, giving many employees within a team more job autonomy also encourages single employees to seek more knowledge within the team. Furthermore, when composing teams, managers should not only take into account the absolute age of team members, but also the age diversity, as it is the relative age to other team members that influences the frequency of knowledge transfer behaviors.
2.6.7. Limitations

The present study has some limitations that should be noted. First of all, we only examine knowledge transfer within teams. Consequently, our results cannot be generalized to transfer across team borders. More generally, the generalizability is limited since data were collected from two German companies in a cross-sectional design. Accordingly, our sample might not be representative for all organizations, and inferences cannot be made about the direction of effects.

Moreover, we did not differentiate between different kinds or characteristics of knowledge. The influences might have differed for sharing tacit versus explicit knowledge (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka & von Krogh, 2009), more versus less ambiguous knowledge (Szulanski, 1996, 2000; Szulanski, Cappetta, & Jensen, 2004), or more versus less codifiable knowledge (Reagans & McEvily, 2003). However, these distinctions have already been well researched and are widely accepted, and introducing a third distinction in the present study would not only have complicated matters in a non-negligible manner, but would also have rendered the parsimonious approach to measurement impossible.

Furthermore, limitations with respect to the operationalization of constructs have to be mentioned; independent as well as dependent variables were operationalized via self-reports, and the scales we used were very parsimonious, measuring constructs with only two to four items.

First, using only one measurement source can entail common method bias that can inflate or deflate the estimations of relationships between constructs (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To control common method bias, we took several steps recommended by Podsakoff and colleagues (2003) when designing the study’s procedure: we protected respondents’ anonymity and reduced evaluation apprehension as much as possible. Furthermore, we improved scale items by reducing ambiguity through the clarification of key
concepts (such as knowledge sharing) when participants had questions while filling out the questionnaire, and by using different scale endpoints and formats for predictor and outcome measures. Second, using very short scales may result in low reliabilities and in a reduction of effects sizes. On the other hand, measurements with few or even single-items have been shown to be reliable for many constructs, including job satisfaction and job effectiveness (Wanous & Hudy, 2001), and knowledge transfer (Kankanhalli et al., 2005; Watson & Hewett, 2006; Zárraga & Bonache, 2005). Indeed, we obtained satisfactory reliabilities and could demonstrate significant effects of the independent on the dependent variables in spite of the rather short scales.

2.6.8. Future research directions

Future research could, in addition to research issues already mentioned (inconsistencies regarding age effects on knowledge transfer or effects of extrinsic benefits on knowledge sharing), examine the influence of within-team sharing and seeking knowledge on individual and team performance. Similar to the study of predictors, outcomes of knowledge transfer have to date also mainly been studied for either knowledge sharing (Cummings, 2004; Quigley et al., 2007) or knowledge transfer (e.g., Collins & Smith, 2006). Furthermore, it would be interesting to investigate the (re)use of transferred knowledge. According to some authors, successful knowledge transfer does not end with the recipient receiving knowledge, but with the recipient unit applying the transferred knowledge. This has been claimed with respect to knowledge transfer at the business unit level (Kostova, 1999; Szulanski, 1996) as well as for individual-level transfer (Watson & Hewett, 2006).
2.7. Conclusion

With the present study, we have made two important contributions: First, by jointly investigating and comparing predictors’ effects on sharing and seeking knowledge within teams, we rendered empirical support to the notion that these are two distinct behaviors with differing antecedents. Thus, we demonstrated that separating sharing and seeking behaviors can help better understand the underlying mechanisms of knowledge transfer. Second, we presented that, at least in some cases, important predictors cannot be discovered when data are analyzed without differentiating the individual and contextual levels.

Hence, we have shown that scientists as well as practitioners have to take a closer look at predictors of knowledge transfer in teams and should use the presented distinctions in future research in order to clarify the picture of influencing factors.
2.8. References


2.9. Appendix

Measures of Knowledge Transfer

Knowledge sharing.
How often do you share experience and knowledge with colleagues?

1. How often have you lately passed on factual knowledge to colleagues?
2. How often have you lately passed on experience to colleagues?

Knowledge seeking.
How often do you ask colleagues for their experience and knowledge?

1. How often have you lately asked colleagues for factual knowledge?
2. How often have you lately asked colleagues for their experience?

These questions were answered on a 6-point Likert scale ranging from 1 = never to 6 = very frequently.

Measures of Motivation

Intrinsic motivation.

1. I find it rewarding when others use my experiences and knowledge.
2. I find it rewarding when I can improve my work by exchanging knowledge with colleagues.
3. Exchanging knowledge with colleagues helps you better develop your professional potential. (item dropped)

Extrinsic motivation.

1. Exchanging knowledge with colleagues improves your chances to get a promotion or better pay.
2. Exchanging knowledge with colleagues helps you gain visibility within the company / team.
3. Exchanging knowledge with colleagues improves your chances of being assigned to interesting tasks.

*These questions were answered on a 4-point Likert scale ranging from 1 = strongly disagree to 4 = strongly agree.*

**Measure of Job Autonomy**

1. I have the freedom to decide what I do on my job.
2. I have a lot of say about what happens on my job.
3. I decide when I take breaks.
4. It is basically my own responsibility to decide how my job gets done.

*These questions were answered on a 4-point Likert scale ranging from 1 = strongly disagree to 4 = strongly agree.*

**Measure of a Climate Supporting Innovativeness**

1. In my team, it is ok to take risks even if they turn out to be a failure.
2. In my team, it is common to find new ways to perform a task.
3. In our team, you are encouraged to suggest new ideas.

*These questions were answered on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.*
3. Intergenerational Knowledge Transfer in Work Teams: A Multilevel Social Network Perspective

In the first paper, presented in the previous chapter, I was interested in day-to-day knowledge transfer in teams, i.e., in what makes it work and what has to be taken into account in investigations of this topic. In the present empirical chapter, which is based on data collected at three branches of a German public administration, I focus on a very specific form of knowledge transfer, namely on intergenerational knowledge transfer. Intergenerational knowledge transfer bears an increased importance for the prevention of knowledge loss, as it is usually veteran employees who retire and who are supposed to transfer their knowledge to younger colleagues or successors. Thus, the question arises in how far such transfer occurs naturally, i.e., simply due to the age difference between two employees, and in how far it has to be encouraged, supported, or even forced to work. With the study presented in this chapter, I take a first step toward answering these questions.

3.1. Abstract

With the demographic change and the imminent waves of retirement, a threat of knowledge loss for organizations becomes more and more apparent. One means of prevention is an increased intergenerational knowledge transfer from older to younger employees. By integrating ideas from social network analysis in a multilevel framework, the present study addresses the so far under-researched topic of intergenerational knowledge transfer. Age effects on knowledge transfer in teams are investigated at three different levels of analysis; an effect of age difference at the dyadic, of age at the individual, and of age diversity at the team level. Taking a social network approach, survey data were collected from 331 employees at a...
German public administration. Results from multilevel analysis show that age diversity within the team and dyadic age difference have positive effects on knowledge transfer, while the latter is conveyed by a difference in experience. Individual age did not show a significant influence. Thus, there is intergenerational knowledge transfer in the form of more exchange from older to younger employees, but older employees do not generally transfer more knowledge.

### 3.2. Introduction

The developed countries are facing a demographic change that will affect the population as a whole as well as the workforce. For example, the mean age of the US-American workforce has been increasing over the last 30 years from 35 years in 1980 to 41 years in 2006 (Bureau of Labor Statistics, 2006). Low birthrates and a rising life expectancy are reshaping the population pyramids, leading to larger cohorts of older employees in organizations, with fewer young workers entering the workforce, and extended work lives for older workers (Leibold & Voelpel, 2006; Ng & Feldmann, 2008; Vaupel & Loichinger, 2006). By now, the baby boomer generation, i.e., the large group of people born between 1946 and 1966, is beginning to retire. As a result, large waves of employees will soon leave the organizations. These employees, for whom it was characteristic to stay in the same company for most of their working lives (e.g., D’Amato & Herzfeldt, 2008; Lancaster & Stillman, 2002), have gathered a huge amount of experience and knowledge; knowledge that the organizations will have much difficulty to replace when its owners have retired.

This poses a serious problem for organizations, because knowledge is considered one of the main organizational assets: the widely accepted knowledge-based view of the firm (Grant, 1996, 1997; Spender, 1996) suggests that knowledge is a productive resource which yields competitive advantage (Alavi & Leidner, 2001; Argote & Ingram, 2000; Argote, Ingram,
Intergenerational Knowledge Transfer in Work Teams: A Multilevel Social Network Perspective

Levine, & Moreland, 2000; Szulanski, 1996). Knowledge is personalized information related to facts, procedures, ideas, and observations (Alavi & Leidner, 2001), and is created by and resides foremost in individual employees (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Nonaka, 1994). Many studies have empirically shown that the dissemination of knowledge has an influence on several organizational outcomes such as individual performance (Quigley, Tesluk, Locke, & Bartol, 2007), work group performance (Cummings, 2004; Mesmer-Magnus & DeChurch, 2009), firm or franchise productivity (Collins & Smith, 2006; Darr, Argote, & Epple, 1995; van Wijk, Jansen, & Lyles, 2008), and innovativeness (van Wijk et al., 2008).

Accordingly, knowledge loss due to employees leaving the organization can incur high costs (DeLong, 2004; Leibold & Voelpel, 2006). One knowledge retention strategies is the direct knowledge transfer from veteran employees to their successors or younger colleagues (DeLong, 2004). Thus, intergenerational knowledge transfer, and more specifically the transfer from older to younger employees, is one necessary component for organizations to retain their intellectual capital and competitive advantage.

Surprisingly, although different antecedents as well as outcomes of knowledge transfer at different organizational levels have been researched extensively (Argote et al., 2000; Foss, Husted, & Michailova, 2010; van Wijk et al., 2008), and the threat of losing knowledge is a pressing issue, the knowledge transfer between different age groups has not yet been investigated empirically. More generally, age has either been used as a control variable at the employee level (Gray & Meister, 2004; Kankanhalli, Tan, & Wei, 2005; Watson & Hewett, 2006) or has been investigated at the business unit or organizational level (van Wijk et al., 2008). Thus, a thorough investigation of the effects of individual age, and especially of the age difference between individuals on knowledge transfer is missing.
The present paper aims to fill this research gap by investigating age effects related to intergenerational knowledge transfer at three different levels of analysis: the dyadic level (i.e., between two employees), the individual level, and the team level, as well as examine experience as a potential conveying factor of age effects.

3.3. **Theoretical Background**

Argote and Ingram (2000, p. 151) defined knowledge transfer in organizations as “the process through which one unit (e.g., group, department, or division) is affected by the experience of another,” although unit can also be a single employee. Thus, knowledge transfer can be studied at various levels within the organization (Argote et al., 2000). Knowledge transfer between single employees, which we define as the process through which one employee receives knowledge from another, is one of the most basic ways of transferring existing knowledge (Bock, Zmud, & Kim, 2005; Watson & Hewett, 2006). As the loss of knowledge starts with the departure of a single employee, and as retirees should transfer their knowledge to a colleague for the prevention of such knowledge loss, we focus on the inter-individual level, i.e., the exchange within dyads of employees, for the study of (intergenerational) knowledge transfer.

We define intergenerational knowledge transfer as the transfer of knowledge between two employees, namely a source and a recipient (Szulanski, 1996), between whom there is a larger age difference (although the difference might be smaller than what is usually termed a generation). This includes the transfer from older to younger employees as well as the transfer from younger to older employees. With respect to knowledge retention however, the transfer of the knowledge of older employees, i.e., sources with a higher age, is of special importance. Accordingly, when considering intergenerational knowledge transfer, our focus is on the
Intergenerational knowledge transfer from older to younger employees, and following DeLong (2004), we assume that to prevent knowledge loss, an increased intergenerational knowledge transfer is necessary.

Intergenerational knowledge transfer can occur in various organizational settings, such as in mentoring relationships (Allen, Eby, Poteet, Lentz, & Lima, 2004), in joint further training of younger and older employees, and, of course, in daily work activities within more or less age diverse teams (Hagestad & Uhlenberg, 2005). Although all of these settings might be interesting to study, we will focus on day-to-day work in teams, as this is the most natural and surely most frequent of the possible settings and exists in all kinds of organizations, no matter of what size. More specifically, we will focus on work teams that work together on a long-term basis in contrast to project teams, which are created for only a few months and then dissolved.

In the following, drawing on theories and results from life-span psychology (intergenerational relations, age stereotypes) and organizational behavior (organizational citizenship behavior, contextual performance, diversity), we will argue that intergenerational knowledge transfer is prominent in teams in terms of an influence of age on knowledge transfer at different levels. The proposed relationships are then summarized in a research model. In a next step, we will demonstrate how a social network approach can be employed to test this model, followed by the description of an empirical survey study conducted to this end. Results are then discussed on the basis of the presented theoretical framework.

3.3.1. Knowledge transfer from older to younger (intergenerational knowledge transfer)

The idea that older and more experienced individuals are inclined to pass on their knowledge to younger generations is not new. About 60 years ago, Erikson (1950) introduced the concept of generativity within the framework of his life-span theory. Generativity, which is loosely
associated with the middle adulthood years, describes “the concern in establishing and
guiding the next generation” (Erikson, 1963, p. 267). It manifests itself in nurturing, teaching,
leading, and promoting the next generation. Generativity can be expressed in a variety of
ways and settings, naturally in parenthood, but also in work life, and professional activities, or
even leisure-time engagements. The concept of generativity has been widely researched
within the family context (e.g., McAdams, Diamond, St. Aubin, & Mansfield, 1997; Peterson,
2002; Peterson, Smirles, & Wentworth, 1997), but there is very little systematic research on
intergenerational relationships outside the family setting (Kessler & Staudinger, 2007).

One possible application of generativity is the transfer of knowledge in organizations.
According to various authors, generativity includes a concern for transmitting life experience
to the young generation (Kotre, 1984; McAdams, 2001), and some of the generativity
measurements even include items referring to passing on knowledge (“I try to pass along the
knowledge I have gained through my experiences”, McAdams & de St. Aubin, 1992; “Is
turned to for advice and reassurance”, Peterson & Klohnen, 1995). Thus, generativity would
result in a natural transfer of knowledge from older to younger employees. In other words, if
an older source were faced with a younger recipient, generativity would suggest more transfer
than if there was no age difference between source and recipient (or if the recipient was
older).

Moreover, according to a large number of authors, age is related to job experience,
organization and team tenure, and comes with an increase in crystallized intelligence,
experiential knowledge, and greater general expertise (e.g., Artistro, Cervone, & Pezzuti,
2003; Baltes, Staudinger, Maercher, & Smith, 1995; Colonia-Willner, 1998; Kanfer &
Ackermann, 2004). Although there might be some work environments where knowledge is
rapidly changing and, thus, does not accumulate with age, the relationship between age and
knowledge should hold for the larger part of stable working environments. In such contexts,
older employees usually know more than younger ones, that is, there usually exists an asymmetry in knowledge and experience between older and younger. Furthermore, those who have less knowledge and experience should seek out those who have it for help and advice, so that those who have more knowledge also generally share more. Accordingly, if the source is older than the recipient, the knowledge asymmetry related to this age difference would suggest more transfer from source to recipient than if there was no age difference between the two employees (or if the recipient was older).

Based on the above generativity and experience asymmetry arguments we predict:

**HYPOTHESIS 1a:** The age difference between the source and the recipient is positively related to knowledge transfer from source to recipient.

The knowledge and experience asymmetry is actually the reason why intergenerational knowledge transfer is so important. The knowledge that older employees have ahead of their younger colleagues is the knowledge that is supposed to be prevented from loss to the organization by intergenerational knowledge transfer.

### 3.3.2. Older sources and knowledge transfer

The asymmetry between older and younger employees should not only lead to more transfer from older to younger employees, it should moreover have the effect that older employees generally transfer more knowledge to colleagues, no matter how old recipients are. Oftentimes, there is a high degree of specialization in teams, and with their accumulated experience and knowledge older employees are frequently experts in their fields. Therefore, many team colleagues, not just the younger ones, should turn to them for help or advice. But older employees should not only transfer more knowledge because they are sought out as sources of knowledge more often than younger employees. As we will argue in the following,
older employees should also transfer more knowledge because they are more willing to share it.

There is a wealth of research demonstrating that age is related to several organizational behaviors which are favorable in the light of organizational outcomes (for an overview see Bowen, Noack, & Staudinger, 2010). First, beginning in midlife, intrinsic rewards become more important at work (Penner, Perun, & Steuerle, 2002), and helping and sharing with colleagues constitute such rewarding experiences. Thus, as employees age, their cost-benefit ratio of transferring knowledge to colleagues seems to change in favor of sharing their knowledge. Second, research has provided links between age and emotional stability (Mroczek & Spiro, 2005; Staudinger, 2005), which in turn has been linked to job satisfaction (e.g., Judge & Locke, 1993; Tokar & Subich, 1997; Watson & Slack, 1993). It can be assumed that employees who are more satisfied with their job are more open to engage in behaviors that are discretionary and not directly part of their core tasks, but beneficial for the organization – such as knowledge transfer. This might especially be true for those who will leave the company soon. Third, although age seems to be largely unrelated to task performance according to meta-analytical evidence, a relationship exists between age and organizational citizenship behaviors (OCB; Ng & Feldman, 2008). OCB is a form of non-core task performance that is beneficial for organizations (Podsakoff, MacKenzie, Paine, & Bachrach, 2000), but is neither job-specific nor directed at the job tasks as such. Examples of OCB are helping coworkers, compliance with organizational norms, or voluntarily taking over additional work (Smith, Organ, & Near, 1983) – and knowledge transfer could be considered as a special form of such behavior.

Taken together, this research draws a picture of older workers as being sought out as sources of knowledge more often than their younger colleagues as well as being more willing to invest time and energy in personal interactions with their colleagues, to show helping
behaviors, and to be more satisfied and involved in the team. These are all favorable characteristics for the engagement in knowledge transfer with team colleagues, irrespective of the age of these colleagues. Thus, we predict:

**HYPOTHESIS 1b:** The age of the source is positively related to knowledge transfer from source to recipient.

With respect to the prevention of knowledge loss, this is a favorable effect as well; older employees who are in danger of leaving the company and carrying with them a lot of knowledge should preferably transfer more knowledge to colleagues, and not necessarily only to the very young colleagues.

### 3.3.3. Knowledge transfer in age diverse teams

Team constellations with respect to age can also be more or less favorable for the prevention of knowledge loss and the enabling of intergenerational knowledge transfer. Age diversity within the team plays an important role here. Generally, the effect of age diversity on work outcomes is a double-edged sword, resulting as positive or as negative depending on individual as well as social or contextual factors (e.g., van Knippenberg, de Dreu, & Homan, 2004; van Knippenberg & Schippers, 2007). For intergenerational interactions (Hagestad & Uhlenberg, 2005), however, age diverse teams and workplaces are an important arena, and give rise to the possibility of such interactions and intergenerational knowledge transfer in the first place. Although one might assume that knowledge transfer in age diverse teams is impeded by negative age stereotypes (e.g., Hess, Auman, Colcombe, & Rahhal, 2003; Kessler & Staudinger, 2007; Posthuma & Campion, 2009), it has been shown that intergenerational contact (which is a constant given in age diverse teams) actually reduces negative age stereotypes (Bales, Eklund, & Siffin, 2000; Meshel & McGlynn, 2004). Thus, age diversity in teams enables rather than impedes intergenerational knowledge transfer.
Moreover, social category diversity, such as age or gender diversity, in teams has been shown to lead to higher satisfaction with, intent to remain in, and stronger commitment to the team (Jehn, Northcraft, & Neale, 1999). Accordingly, it can be argued that age diversity creates, possibly because it decreases intragroup competition, a climate in which team members are more satisfied and more committed to the work group. Thus, team members will have a personal interest in a good overall team performance and will be more willing to transfer their own knowledge to other members of the team. Therefore, we can assume that age diversity not only enables more intergenerational knowledge transfer, but also increases knowledge transfer within the team directly. Thus, we predict:

**HYPOTHESIS 1c:** Age diversity within the team is positively related to knowledge transfer from source to recipient.

### 3.3.4. Experience as a conveying factor

All of these three factors, be it age difference, individual age, or age diversity, influence knowledge transfer because they go along with some other changes or circumstances, for example, a larger difference in experience between individual employees, a more favorable climate in the team, or a higher amount of OCB and experience in individuals. Therefore, in addition to the underlying effects of age, we want to investigate the effect of one of the proposed age-related changes, namely the effect of accumulated experience and knowledge. This factor especially lends itself to the analysis within the present framework as, like age, it can be employed in the form of a difference score for dyads as well as an individual characteristic, i.e., as the difference in experience and knowledge between source and recipient as well as the source’s experience and knowledge. As a proxy for experience and accumulated job relevant knowledge, team tenure seems most appropriate. Team tenure refers to the length of time an individual has been with the team (Schippers, den Hartog, Koopman,
& Wienk, 2003) and, thus, describes for how long an employee has been doing the present or similar tasks within the presence of the same contextual factors. Therefore, it contains information about how long the employee has been able to collect knowledge about tasks, the organization, the people directly working with, etc. Thereby, team tenure provides more information about relevant knowledge and experience than job tenure or organizational tenure, although it of course only captures a quantitative aspect of experience.

In equivalence to Hypothesis 1a, we argue that, if the source has longer team tenure than the recipient, the source should transfer more knowledge to the recipient due to the experience asymmetry. Accordingly, we predict:

HYPOTHESIS 2a: The difference in team tenure between the source and the recipient is positively related to knowledge transfer from source to recipient (and this beyond the influence of the age difference between source and recipient).

If this difference in team tenure can explain variance over and above the effect of age difference and diminishes the effect of age difference at the same time, it can be argued that the effect of age difference on knowledge transfer exists because it is accompanied by a difference in experience. Other explanations such as generativity would then not play a dominant role.

Furthermore, we can argue, in equivalence to Hypothesis 1b, that sources who have a longer team tenure should have a certain expert status and should be sought out more due to their experience by team colleagues, irrespective of the team colleagues’ age or team tenure. Therefore, we predict:

HYPOTHESIS 2b: The team tenure of the source is positively related to knowledge transfer from source to recipient (and this beyond the influence of the age of the source).

Again, if individual team tenure can explain variance over and above the effect of individual age and can diminish the effect of age at the same time, we can assume that the
effect of age on knowledge transfer mainly exists because with age, team tenure increases (and, thus, experience and knowledge), and this in turn has an influence on knowledge transfer. Other factors such as OCB would then not play a dominant role in the explanation of the age effect.

The presented hypotheses are summarized in a research model that is displayed in Figure 3. In the following, we will describe how this model can be empirically tested using a multilevel social network approach.

### 3.3.1. Multilevel social network approach

A social network can be defined as "a set of actors and one or more relations between the actors" (Contractor, Wasserman, & Faust, 2006, p. 682). Within organizations, many processes and structures have been described in terms of such social networks, e.g., the diffusion and adoption of innovations (Coleman, Katz, & Menzel, 1957, 1966; Rogers, 1979)

![Figure 3. Model of factors influencing knowledge transfer within teams.](image)
or exchange and power (Cook & Emerson, 1978; Cook, Emerson, Gillmore, & Yamagishi, 1983; Markovsky, Willer, & Patton, 1988).

Also knowledge transfer within and across organizations has been researched within the framework of social network analysis (Darr et al., 1995; Hansen 1999, 2002; Levin & Cross, 2004; Reagans & McEvily, 2003). Knowledge transfer within teams, for example, can be interpreted in terms of a network, with individual employees as actors, and the knowledge transfer as relations between them (see Figure 4a, with employees denoted as A, B, C, and D, and knowledge transfers as arrows KT).

Figure 4. A network approach to knowledge transfer within teams.
Each employee can act as a source and transfer knowledge to every other team colleague (e.g., knowledge transfer from A to B, KT$_{A \rightarrow B}$, with A as source) as well as act as a recipient and receive knowledge transfer from each of the team colleagues (KT$_{B \rightarrow A}$, with A as recipient).

Following such a design, each knowledge transfer from one employee to another (i.e., each dyadic transfer) constitutes an observation. Dyadic knowledge transfer is also the unit of analysis in the research model presented in Figure 4. As mentioned by several authors (Levin & Cross, 2004; Reagans & McEvily, 2003; van Duijn, van Busschbach, & Snijders, 1999), this dyadic level of analysis bears the problem of non-independence of observations or data: Considering Figure 4a, KT$_{A \rightarrow B}$ will be more similar to KT$_{A \rightarrow C}$ than to KT$_{C \rightarrow D}$, simply because, in both relationships, the source is the same (A) and influences both transfers in a specific manner. Using the terminology of multilevel analysis (Bliese, 1998; Hofmann, 1997; Hox, 2002; Raudenbush & Bryk, 2002), dyads are nested within sources (i.e., employees). Furthermore, as we do not only look at different dyads and different employees, but also at different teams and their characteristics, these considerations have to be taken one step further (see Figure 4b). Following the same line of argument, KT$_{A \rightarrow B}$ should be more similar to KT$_{C \rightarrow D}$ (because both A and C belong to the same team) than to KT$_{E \rightarrow F}$. Thus, for our research model, dyadic knowledge transfer relations are not only nested within employees (sources), but employees (sources) are also nested within teams.

One statistical solution for the problem of non-independence is multilevel analysis, also known as hierarchical linear modeling. This method is often used when students are nested within schools, employees within teams, or several observations across time within one individual (Bliese, 1998; Hofmann, 1997; Hox, 2002; Raudenbush & Bryk, 2002). The advantage of multilevel modeling is that it not only allows the analysis of data with a nested structure, but also enables the simultaneous investigation of effects of independent variables.
at different levels (e.g., individual level and team level). The integration of these two approaches, the social network approach and multilevel analysis, has been first proposed by Snijders, Spreen, and Zwaagstra (1995) and then been further developed by van Duijn and colleagues (1999). According to the latter group of authors, the application of multilevel analysis to social networks is rather simple: when the relations between actors constitute the dependent variable, then these relations between actors are located at the first, dyadic level, and the individual actors within which the relations are nested are located at the second, individual level. In the case of the present research model, the teams that the individual employees are nested in constitute a third level, i.e., the team level. Thus, by combining the social network approach with a multilevel analysis, we have an ideal framework to test our model, we Furthermore enrich the present literature by taking a third, i.e., the team level into account, and moreover answer the call for multilevel approaches, which include the micro level of analysis, in knowledge transfer research (Foss et al., 2010).

3.4. Method

3.4.1. Sample and data collection

The study was conducted at three branches of a German public administration. This setting was chosen as it presents a stable environment for employees in which experience and knowledge can accumulate with age, other than in some rapidly changing contexts. N=349 online-questionnaires were filled out by employees and supervisors stemming from 72 teams. Two teams which formed subunits of another, larger team in the data sample had to be excluded to avoid the double inclusion of the same dyads. Eleven teams had to be eliminated from the data set as only one team member each had filled out the questionnaire, and no dyadic information could be computed. Thus, the sample resulted in N=1940 dyads, stemming from 331 participants (283 employees, 48 supervisors) belonging to 59 teams.
Participants had a mean age of 48.3 years (SD=9.4) and a mean team tenure of 7.0 years (SD=6.5), with 22% of them working part-time. After an open information session, prospective participants received an email-invitation to take part in the study, and had three weeks to fill in the online questionnaire. The overall response rate was 58.4%.

This sample was especially appropriate to test our research question as the age structure within the sample already mirrored very well the demographic change that many organizations will be facing; 4.8% of the sample were younger than 30 years, 30.8% between 30 and 45 years, and 64.4% over 45 years old. Thus, the perceived pressure to prevent knowledge loss was large.

### 3.4.2. Measures

As the study was conducted in German, scales stemming from the English-speaking literature were translated into German, then independently back-translated into English and compared to the original version. Where there were inconsistencies, they were resolved by the translators (a procedure recommended by Brislin, 1980).

**Independent variables.** Age was registered via birth date. To compute the *age difference for a dyad*, the age of the recipient was subtracted from the age of the source. For *age diversity* within the team, the standard deviation (corrected for a bias due to group size) $SD_N$ was calculated according to Biemann and Kearney (2010) in the following manner:

$$SD_N = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{q}}$$

(1)

with

$$q = \frac{(N-1)}{C_N}$$

(2)

and

$$C_N = \frac{\Gamma\left(\frac{N-1}{2}\right)\sqrt{\frac{N-1}{2}}}{\Gamma\left(\frac{N}{2}\right)}$$

(3)
where $N$ is the group size and $\Gamma$ is the Gamma function. A table of $q$ values for different group sizes can be found in Cureton (1968).

Team tenure was measured with one item, specifying years and months of affiliation with the present team. The difference in team tenure for a dyad was then calculated in equivalence to the age difference, subtracting the recipient’s team tenure from the source’s team tenure.

Knowledge transfer. In accordance with previous research, we measured knowledge transfer as a frequency (Cummings, 2004; Kankanhalli et al., 2005). Following a round robin design (Gleason & Halperin, 1975; Warner, Kenny, & Stoto, 1979) or sociometric technique with a fixed roster (Reagans & McEvily, 2003; Wasserman & Faust, 1994), we supplied participants with a coded list of the names of their team colleagues (information obtained from the respective coordinating unit within the administration) and asked them how often they had a) shared knowledge with and b) sought knowledge from each of their colleagues within the last three months, rating the frequency on a five-point Likert scale ranging from “very seldom” to “very often”. Answers in the survey were coded accordingly, so as to allow for assignment of colleague ratings to the right source and recipient without including actual names in the questionnaire. With this procedure, we obtained, for each dyad, information about four processes; the frequency of the source sharing knowledge with the recipient, of the recipient seeking knowledge from the source, the frequency of the recipient sharing knowledge with the source, and of the source seeking knowledge from the recipient.

To receive an estimation of the frequency of transfer from a source to a recipient within a dyad, two items, namely the source’s rating concerning the frequency of sharing knowledge with the recipient, and the recipient’s rating concerning the frequency of seeking knowledge from the source, were averaged. By averaging the subjective information from two sources, we thus obtained a more objective measure of the dependent variable. The correlation between the source’s and recipient’s rating reached 0.47. Similar to the calculation of an
ICC(1), we analyzed the distribution of variance for knowledge transfer across the different levels (see section 3.4.3. for the respective formula); 77% of the variance was due to differences between dyads “within a person”, 11% of the variance was due to individual differences within teams, and 12% of the variance was due to mean differences between teams. According to Bliese (2000), values for ICC(1), in our case equivalent to the amount of variance located at the two higher levels, normally lie between 0.05 and 0.30, so the values obtained here are within a normal range. This shows that knowledge transfer was influenced to a certain degree by characteristics of the source and the team, suggesting non-independence, and calling for a multilevel analysis.

Control variables. To rule out alternative influences on the dependent variable, we controlled for several factors in our analyses. First, as posited by social exchange theory (Blau, 1964; Molm, 1997) and shown by several empirical studies (Bock et al., 2005; Kankanhalli et al., 2005; Wasko & Faraj, 2000), knowledge transfer within a dyad should be largely influenced by reciprocity. Accordingly, the frequency with which the source receives knowledge from the recipient (knowledge reception) should influence the frequency of knowledge transfer from source to recipient.

Knowledge reception was measured in equivalence to knowledge transfer by averaging the source’s rating concerning the frequency of seeking knowledge from the recipient, and the recipient’s rating concerning the frequency of sharing knowledge with the source. Thus, we again averaged two subjective ratings to receive a more objective measure. The correlation was, as before, 0.47. The variance of the resulting variable was distributed across the three levels in the following manner: 83% of the variance was located at the dyadic level, 5% at the individual level, and 12% at the team level. According to the sociometric approach described to measure knowledge transfer and knowledge reception, the data of each dyad A-B appear
twice in the data set, once with person A considered as source, and once with person B as source. However, we do not see this to lead to statistical problems.

Other factors that we controlled for were the following: 1) the source’s status as an employee in or the supervisor of the team, 2) the source having a part-time or full-time contract, 3) the source’s self-reported percentage of knowledge transfer within the team versus beyond the borders of the team (depending on their task, some employees had to collaborate more or less with other teams, customers, or external institutions, which may of course influence the frequency of their knowledge transfer within the team), 4) the number of teams the source formed part of (some participants worked in two or more completely different teams and took part in the survey for several teams – two factors that might influence their report of knowledge transfer), 5) the team size (the larger the team, the less often one can, on average, transfer knowledge to a single colleague), and 6) the source’s membership to one of the branches of the administration via an organization dummy.

3.4.3. Analytical strategy and statistical approach

In a first step, we conducted a missing variable analysis and filled missing data using the expectation-maximization (EM) algorithm (Dempster, Laird, & Rubin, 1977). Missing data were filled for independent as well as dependent variables following Graham’s (2009) recommendation that this produces less bias than listwise or pairwise deletion. In a next step, we computed simple descriptives and zero order correlations. To obtain information about the distribution of variance across the three different levels, we calculated the proportion of variance located at each level equivalent to calculations of the ICC(1) (Bliese, 1998):

\[
prop.\ of\ variance_{Level1} = \frac{\sigma^2}{\sigma^2 + \tau_{00} + \tau_{000}}
\]

(4)

\[
prop.\ of\ variance_{Level2} = \frac{\tau_{00}}{\sigma^2 + \tau_{00} + \tau_{000}}
\]

(5)
Intergenerational Knowledge Transfer in Work Teams: A Multilevel Social Network Perspective

$$\text{prop.of variance}_{\text{Level3}} = \frac{\tau_{000}}{\sigma^2 + \tau_{00} + \tau_{000}},$$  \hspace{1cm} (6)

with $\sigma^2$ as the between-dyad variance at the dyadic level (Level 1), $\tau_{00}$ as the between-person variance at the individual level (Level 2), and $\tau_{000}$ as the between-team variance at the team level (Level 3).

As mentioned before, our data were non-independent with dyads nested within persons and persons within teams. For the hypotheses tests, we thus used multilevel modeling techniques (Bliese, 1998; Hofmann, 1997; Hox, 2002; Raudenbush & Bryk, 2002). Employing the HLM 6.08 statistical package, we built the following three-level models: in a first step we inserted the control variables at all three levels, centered around their grand means (Model 1). For knowledge reception, as well as the subsequent explanatory variables entered at the dyadic level, we assumed random slopes as we expected unexplained variability between individuals in the effect of these variables. In a second step, we entered the age difference at the dyadic level, age of the source at the individual level, and age diversity at the team level to investigate the various age related effects on knowledge transfer (Model 2). In a last step, we entered difference in team tenure at the dyadic and the source’s team tenure at the individual level to test one of the potential direct effects associated with the age effects (Model 3).

In order to check if the respective model could account for variance in the dependent variable, goodness of fit equivalent to the $R^2$ in regression statistics was calculated following a procedure suggested by Raudenbush and Bryk (2002). First, a one-way ANOVA model was computed in HLM with knowledge transfer as dependent variable. Then, the values for $\sigma^2$, $\tau_{00}$, and $\tau_{000}$ from this baseline model were compared with the $\sigma^2$, $\tau_{00}$, and $\tau_{000}$ values from subsequent models in the following manner:

When dyad level predictors were added

$$R^2 = \frac{\hat{\sigma}^2(\text{baseline model}) - \hat{\sigma}^2(\text{extended model})}{\hat{\sigma}^2(\text{baseline model})},$$  \hspace{1cm} (7)
when individual level predictors were added

$$R^2 = \frac{\hat{\tau}_{00}(\text{baseline model}) - \hat{\tau}_{00}(\text{extended model})}{\hat{\tau}_{00}(\text{baseline model})}$$ \hspace{1cm} (8)

and when team-level predictors were added

$$R^2 = \frac{\hat{\tau}_{000}(\text{baseline model}) - \hat{\tau}_{000}(\text{extended model})}{\hat{\tau}_{000}(\text{baseline model})}$$ \hspace{1cm} (9)

3.5. Results

3.5.1. Descriptive results

Descriptive statistics, including zero-order correlations, can be found in Table 4 (for dyad and individual level variables) and in Table 5 (for team level variables). However, estimations in the correlation matrices should be interpreted with caution, since they only depict zero-order correlations and do not take the non-independence of the data into account.

3.5.1. Hierarchical linear modeling

In Table 6, results of the hypotheses tests are presented. Model 1 in Table 6 depicts the relationships between the control variables and knowledge transfer, Model 2 and Model 3 additionally present the results for the hypothesized relationships between independent variables and knowledge transfer.

As shown in Model 1, knowledge reception was positively related to knowledge transfer ($\gamma = 0.784$, $p = 0.000$). As can be seen in Model 2 and 3, knowledge reception had the strongest relationship with knowledge transfer even when other variables were added. Furthermore, the participating supervisors transferred knowledge more often than did their subordinates ($\gamma = 0.162$, $p = 0.019$). This effect held true even when the independent variables
### Table 4

**Descriptive Statistics and Zero-Order Correlations for Dyad Level and Individual Level Variables at the Respective Level**

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
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<th>10</th>
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<tbody>
<tr>
<td><strong>Individual Level</strong></td>
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<tr>
<td>1. Knowledge transfer</td>
<td>2.84</td>
<td>1.12</td>
<td>1940</td>
<td>0.64</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2. Knowledge reception</td>
<td>2.84</td>
<td>1.12</td>
<td>1940</td>
<td>0.82***</td>
<td>0.64</td>
<td></td>
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<tr>
<td>3. Age difference</td>
<td>0.00</td>
<td>12.92</td>
<td>1940</td>
<td>0.05*</td>
<td>-0.05*</td>
<td>-</td>
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<tr>
<td>4. Team tenure difference</td>
<td>0.00</td>
<td>8.50</td>
<td>1940</td>
<td>0.07**</td>
<td>-0.07**</td>
<td>0.47***</td>
<td>-</td>
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<tr>
<td><strong>Team Level</strong></td>
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<tr>
<td>5. Supervisor a</td>
<td>1.15</td>
<td>0.35</td>
<td>331</td>
<td>0.30***</td>
<td>0.28***</td>
<td>0.14*</td>
<td>0.05</td>
<td>-</td>
<td></td>
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<tr>
<td>6. Full-time b</td>
<td>2.75</td>
<td>0.49</td>
<td>331</td>
<td>0.17**</td>
<td>0.14*</td>
<td>-0.02</td>
<td>0.02</td>
<td>0.19**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7. percent exchange within team</td>
<td>62.14</td>
<td>25.83</td>
<td>331</td>
<td>0.01</td>
<td>0.06</td>
<td>-0.05</td>
<td>0.06</td>
<td>-0.03</td>
<td>-0.21***</td>
<td>-</td>
<td></td>
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<tr>
<td>8. Number of teams working in</td>
<td>1.43</td>
<td>0.63</td>
<td>331</td>
<td>0.18**</td>
<td>0.17**</td>
<td>0.07</td>
<td>-0.03</td>
<td>0.44***</td>
<td>0.21***</td>
<td>-0.30***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Age</td>
<td>48.32</td>
<td>9.40</td>
<td>331</td>
<td>0.13*</td>
<td>0.01</td>
<td>0.87***</td>
<td>0.39***</td>
<td>0.12*</td>
<td>-0.04</td>
<td>-0.03</td>
<td>0.10†</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10. Team tenure</td>
<td>7.03</td>
<td>6.45</td>
<td>331</td>
<td>0.13*</td>
<td>-0.03</td>
<td>0.34***</td>
<td>0.80***</td>
<td>0.02</td>
<td>0.03</td>
<td>0.16**</td>
<td>-0.15**</td>
<td>0.39***</td>
<td>-</td>
</tr>
</tbody>
</table>

**Notes.** Upper rows represent statistics for the dyadic level. Cronbach’s alphas in the diagonal. For correlations with individual level variables, dyad level variables were aggregated to the individual level, e.g., mean age difference within dyads for one individual.

aSupervisor coded as 1 = employee, 2 = supervisor. bFull-time coded as 1 = part-time contract less than 20hrs/week, 2 = part-time employment, 20hrs/week, 3 = full-time employment.

†*p < .10. *p < .05. **p < .01. ***p < .001.
Table 5

**Descriptive Statistics and Zero-Order Correlations for Team Level Variables**

<table>
<thead>
<tr>
<th></th>
<th>Organization dummy</th>
<th>Team size</th>
<th>Age diversity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Descriptives</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>1.66</td>
<td>8.17</td>
<td>9.14</td>
</tr>
<tr>
<td>SD</td>
<td>0.90</td>
<td>4.09</td>
<td>3.74</td>
</tr>
<tr>
<td>N</td>
<td>59</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td><strong>Zero-order correlations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Knowledge transfer</td>
<td>-0.02</td>
<td>-0.43**</td>
<td>0.16</td>
</tr>
<tr>
<td>2. Knowledge reception</td>
<td>-0.02</td>
<td>-0.43**</td>
<td>0.16</td>
</tr>
<tr>
<td>3. Age difference</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Team tenure difference</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Supervisor(^a)</td>
<td>-0.02</td>
<td>-0.30*</td>
<td>-0.24(^{f})</td>
</tr>
<tr>
<td>6. Full-time(^b)</td>
<td>-0.51***</td>
<td>-0.02</td>
<td>-0.01</td>
</tr>
<tr>
<td>7. percent exchange within team</td>
<td>0.28*</td>
<td>0.10</td>
<td>-0.16</td>
</tr>
<tr>
<td>8. Number of teams working in</td>
<td>0.08</td>
<td>-0.30*</td>
<td>0.09</td>
</tr>
<tr>
<td>9. Age</td>
<td>0.24(^{f})</td>
<td>-0.03</td>
<td>-0.47***</td>
</tr>
<tr>
<td>10. Team tenure</td>
<td>-0.08</td>
<td>0.20</td>
<td>-0.20</td>
</tr>
<tr>
<td>11. Organization dummy</td>
<td>-</td>
<td>0.09</td>
<td>0.16</td>
</tr>
<tr>
<td>12. Team size</td>
<td>0.09</td>
<td>-</td>
<td>0.03</td>
</tr>
<tr>
<td>13. Age diversity</td>
<td>0.11</td>
<td>0.07</td>
<td>-</td>
</tr>
</tbody>
</table>

*Notes.* For correlations with team level variables, dyad and individual level variables were aggregated to the team level. No correlations with age difference and team tenure difference could be computed as these variables yield a value of zero when aggregated to the team level.

\(^a\)Supervisor coded as 1 = employee, 2 = supervisor. \(^b\)Full-time coded as 1 = part-time contract less than 20hrs/week, 2 = part-time employment, 20hrs/week, 3 = full-time employment.

\(^{f}\)p < .10. \(^{*}\)p < .05. \(^{**}\)p < .01. \(^{***}\)p < .001.
were added in subsequent models, although it decreased in size. Furthermore, participants with a full-time contract transferred knowledge more often ($\gamma = 0.097, p = 0.048$), again this effect decreased with the introduction of independent variables but stayed significant. Finally, team size showed a negative relationship with knowledge transfer which as well was consistent, but consistently decreasing with the number of further variables introduced ($\gamma = -0.010, p = 0.003$).

Model 2 displays the results for the tests of Hypotheses 1a to 1c. Hypothesis 1a, which suggested a positive relationship between age difference within the dyad and knowledge transfer, was supported ($\gamma = 0.006, p = 0.019$). Hypothesis 1b, which proposed a positive relationship between age of the source and knowledge transfer was not supported – although the effect did show a tendency toward significance ($\gamma = 0.003, p = 0.077$). Furthermore, age diversity within the team was positively related to knowledge transfer ($\gamma = 0.012, p = 0.004$), supporting Hypothesis 1c.

Results for the tests of Hypotheses 2a and 2b can be found in Model 3. At the dyad level, the difference in team tenure between source and recipient is positively related to knowledge transfer, and this beyond the aforementioned effects ($\gamma = 0.014, p = 0.017$). Thus, Hypothesis 2a received full support. Team tenure at the individual level, on the other hand, did not show a significant effect on knowledge transfer, yielding no support for Hypotheses 2b, although the effect had a tendency toward significance ($\gamma = 0.004, p = 0.077$). For the amount of variance explained by each Model see Table 7.
### Table 6

**Hierarchical Linear Models for Knowledge Transfer**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dyadic Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge reception</td>
<td>0.784***</td>
<td>0.787***</td>
<td>0.792***</td>
</tr>
<tr>
<td></td>
<td>(0.027)</td>
<td>(0.025)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>Age difference</td>
<td>0.006*</td>
<td></td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td></td>
<td>(0.003)</td>
</tr>
<tr>
<td>Team tenure difference</td>
<td></td>
<td>0.014*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.006)</td>
</tr>
<tr>
<td><strong>Individual Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisor&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.162*</td>
<td>0.135*</td>
<td>0.134*</td>
</tr>
<tr>
<td></td>
<td>(0.069)</td>
<td>(0.066)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Full-time&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.097*</td>
<td>0.089*</td>
<td>0.088*</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.041)</td>
<td>(0.036)</td>
</tr>
<tr>
<td>% exchange within team</td>
<td>-0.000</td>
<td>0.000</td>
<td>-0.000</td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Number of teams working</td>
<td>-0.024</td>
<td>-0.030</td>
<td>-0.013</td>
</tr>
<tr>
<td>in</td>
<td>(0.032)</td>
<td>(0.032)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td>0.004&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.002)</td>
</tr>
<tr>
<td>Team tenure</td>
<td></td>
<td></td>
<td>0.004&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.002)</td>
</tr>
<tr>
<td><strong>Team Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization dummy</td>
<td>-0.007</td>
<td>-0.022</td>
<td>-0.014</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.018)</td>
<td>(0.017)</td>
</tr>
<tr>
<td>Team size</td>
<td>-0.010**</td>
<td>-0.010**</td>
<td>-0.008*</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Age diversity</td>
<td>0.012**</td>
<td>0.013**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.004)</td>
<td>(0.004)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes.** All variables grand-mean centered. For all variables at the dyadic level random slopes were assumed.

<sup>a</sup>Supervisor coded as 1 = employee, 2 = supervisor.  
<sup>b</sup>Full-time coded as 1 = part-time contract less than 20hrs/week, 2 = part time employment, 20hrs/week, 3 = full-time employment.  
<sup>c</sup>p < .10.  
* p < .05.  
** p < .01.  
*** p < .001.
Table 7

*Variance Explained (in Equivalence to $R^2$) by the Different Models*

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dyadic Level</strong></td>
<td>70.50% (54.30%)</td>
<td>71.10% (54.70%)</td>
<td>72.80% (56.10%)</td>
</tr>
<tr>
<td><strong>Individual Level</strong></td>
<td>40.00% (4.40%)</td>
<td>49.40% (5.40%)</td>
<td>63.20% (7.00%)</td>
</tr>
<tr>
<td><strong>Team Level</strong></td>
<td>99.98% (12.00%)</td>
<td>99.99% (12.00%)</td>
<td>100.00% (12.00%)</td>
</tr>
</tbody>
</table>

*Notes.* Percentage of variance explained at the respective level, explained overall variance in brackets.

3.6. *Discussion*

The objective of the present study was to demonstrate the existence of intergenerational knowledge transfer and other age-related effects on knowledge transfer between individual employees within work teams, as intergenerational knowledge transfer is considered one means to prevent knowledge loss. Results of the survey study demonstrate that there is indeed increased intergenerational knowledge transfer from older to younger employees within teams, and this mainly because older employees are more experienced. Furthermore, results delineate a positive influence of age diversity within teams on knowledge transfer. Even though these age-related effects were significant, dyadic knowledge transfer seems to be influenced mainly by reciprocity.

3.6.1. *Intergenerational knowledge transfer and age-related effects*

Our results show that there is increased intergenerational knowledge transfer in teams, i.e., a certain amount of knowledge transfer is explained solely by the fact that the source is older than the recipient. Although the individual age of the source did not have a significant effect on knowledge transfer as we predicted, the age combination of both employees in a dyad did play a role. Considering the basis of the increased intergenerational knowledge transfer within teams, the present data give a clear indication; as the zero-order correlations show, a difference in age goes along with a difference in team tenure, which we consider as a proxy.
for job-relevant experience and knowledge. Introducing difference in team tenure into our model produced a significant effect, while at the same time it reduced the effect of age difference, so that the latter was no longer significant. Thus, we can assume that other factors, such as generativity, are of minor importance. Considering the problem of loss of knowledge, this is good news, as it is exactly the knowledgeable older employees that you want to engage in intergenerational knowledge transfer. However, the effects are rather small (the addition of the age-related effects in Model 2 only increased the amount of overall explained variance by approximately 1.5%), suggesting that increased intergenerational knowledge transfer does occur “naturally,” but only to a small extent.

Individual age does not seem to play such an important role once the age difference in dyads is controlled for. The hypothesized age effect, which we suggested on the basis of age-related changes in organizational behaviors (Bowen et al., 2010), was not supported. But possibly the failure to show an age effect, and especially an age effect independent of experience, was due to the age distribution within the sample; with a mean age of 48 years and only 4.8% of the sample younger than 30 years, but 64.4% over 45 years old, there might be less variation in factors such as interpersonal concern or OCB. Thus, the sample structure could have decreased the chances to find a larger age effect, and more specifically, an age effect independent of experience.

With the investigation of experience as a possible conveying mechanism, we could demonstrate that large parts of the dyad and individual level age effects, respectively, are due to experience and experience asymmetry between older and younger employees, respectively. Although team tenure only had a significant effect at the dyadic level, it showed a similar pattern of effects at the dyadic and individual level. At the dyadic level, the difference in team tenure had a significant influence on knowledge transfer and reduced the influence of age difference to a non-significant amount. Similarly, team tenure at the individual level had an
effect that showed a tendency for significance and reduced the influence of age, which in the previous model had shown a tendency for significance, to a completely non-significant amount. Although it might be argued that job tenure, i.e., the amount of time the individual has worked in this specific job (not necessarily only in the present organization), better describes the amount of job-specific knowledge, the (difference in) job tenure did not show significant effects at the dyadic or individual level. We checked this in an analysis equivalent to Model 3, which did not yield any significant results. Accordingly, team tenure, which combines information about job-specific and organization-specific knowledge, seems to be the better proxy for experience and knowledge.

The age composition of a team, namely the age diversity within teams, on the other hand, did show a positive effect on knowledge transfer. Thus, although age diversity can generally have positive as well as negative effects on organizational outcomes (see van Knippenberg & Schippers, 2007, for an overview), it positively influenced knowledge transfer in the present study. The mechanisms which convey this effect have not been tested and can only be speculated about. Jehn and colleagues (1999) found a positive effect of age and gender diversity on group morale (satisfaction with, intent to remain in, and stronger commitment to the team), which is in line with career tournament theory (Rosenbaum, 1979). Career tournament theory postulates that employees who are of the same age and, therefore, in the same career cohort are more likely to compete for valued organizational resources, e.g., for a limited number of promotions. As knowledge constitutes such a resource (Grant, 1996, 1997), employees in an age homogenous team might therefore compete for knowledge which would lead to knowledge hoarding rather than knowledge transfer. In an age diverse team, on the contrary, the climate would be much less competitive and more open for transfer and helping behaviors. However, the effect found for age diversity was again a small one, so differences
in knowledge transfer between age homogenous and age diverse teams should be small as well.

3.6.2. Knowledge reception

Of all the variables tested, the transfer that the source received from the recipient had the strongest influence on knowledge transfer. This is in line with previous research: Wasko and Faraj (2000) have shown that participants in newsgroups help other members of these groups, because they themselves received help in the past and feel an obligation to “give back”. Furthermore, Bock and colleagues (2005) as well as Kankanhalli and colleagues (2005) reported that employees who expected reciprocation from others intended to share more knowledge and contributed more to electronic knowledge repositories, respectively. In all of these studies, a generalized rather than person-specific form of reciprocity was considered, that is, the reciprocal relationship was rather between a participant and a group (whose members might not even be known personally). In our study, we consider long-standing relationships between dyads of colleagues who have been working together for years. Thus, expectations as well as obligations should be a lot stronger, as would be the effect on knowledge transfer. Moreover, other variables, such as mutual trust or being on good terms (e.g., Szulanski, 1996), influence both directions of knowledge transfer within a dyad in the same manner, and could have strengthened the relationship between knowledge transfer and knowledge reception in addition to reciprocity effects. But even considering all these arguments, the effect of knowledge reception in the present study is surprisingly strong; over and above the other control variables, knowledge reception alone explained 63% of the overall variance. Thus, this transfer in the opposite direction is a truly powerful predictor. The strength of the relationship was already visible in the high zero-order correlation, reaching an
3.6.3. **Transfer as a matter of dyads, not of individuals**

Interestingly, in the present study, only 11% of the overall variance of knowledge transfer was located at the individual level, suggesting that individual level variables do not have much predictive power. With only another 12% of the variance located at the team level, the transfer from source to recipient is evidently mainly dependent on characteristics of the dyad, for example the combination of characteristics of the two employees forming a specific dyad, and not so much depending on personal characteristics of the source or recipient as such. Moreover, only 5% of the variance of knowledge reception is located at the individual level, demonstrating that characteristics of the recipient have even less predictive power than those of the source. According to our data, there do not seem to be team members who “generally transfer a lot of knowledge”, but rather dyads of employees between whom there is a lot of transfer, and others where there is not. This calls for more research on why these differences arise and if they are task related and therefore controllable, or rather related to personal and interpersonal characteristics and therefore less susceptible to managerial influence.

3.6.4. **Theoretical implications**

Summing up, we can derive several theoretical implications from our results: First, (at least a small amount of) intergenerational knowledge transfer seems to be occurring to an (at least slightly) increased amount in work teams. Vis-à-vis the current demographic development, this should be a fruitful area for future research. We have started to investigate factors related to this phenomenon (i.e., the difference in experience between two employees), but to get a better understanding of intergenerational knowledge transfer, it will be necessary to develop
hypotheses about and test influencing factors as well as outcomes. Second, we have contributed to the diversity literature by showing that age diversity exerts a positive, albeit small influence on knowledge transfer in teams. Third, we have shown that knowledge transfer in teams is rather a matter of dyads and not of individuals. Therefore, we would like to add to Foss and colleagues’ (2010) call for more multilevel knowledge transfer research including individual level variables by suggesting that multilevel research should, at best, also include dyad level variables.

### 3.6.5. Practical implications

The results of the present study have, furthermore, several implications for practitioners in organizations with regard to general influences on knowledge transfer and with regard to intergenerational knowledge transfer within teams as a means to prevent knowledge loss.

First, especially the results for the control variables yield some interesting conclusions. Results show that supervisors deal with a markedly higher frequency of knowledge transfer with their subordinates than the subordinates amongst each other. Although this is in general a favorable result, as supervisors often possess and should share knowledge that the subordinates cannot access otherwise, it also imposes more time, effort, and energy costs on the supervisors (Constant, Sproull, & Kiesler, 1996; Goodman & Darr, 1998; Reagans & McEvily, 2003; Szulanski, 1996). Therefore, it is important to structure and organize these knowledge transfers accordingly, so that they are conducted in an efficient manner. Moreover, results show that employees with a full-time position transfer more knowledge than do those with a part-time contract. Although this appears natural, these results point to the risk of part-time employees being less well integrated into the knowledge networks within the team and the organization as a whole. Especially when there are several part-time workers on the team, an effort has to be made to ensure that information and knowledge reach these employees to the
same extent as the full-time workers. Additionally, it has to be secured that there are enough opportunities for other employees to tap the part-time workers’ knowledge. Moreover, results demonstrated that team size plays a (negative) role in within-team knowledge transfer. Even though it is evident that, within a team of 15, employees cannot transfer knowledge to each team colleague to the same extent as in a team of three, this poses the risk of losing transparency. In larger teams, subgroups can easily form (for example, based on shared tasks) within which a lot of knowledge is transferred, but across whose boarders hardly any transfer takes place. If the knowledge is very task specific and not relevant for other subgroups, there is no harm, but for other types of knowledge relevant for everyone, it is important to create structures ensuring that such knowledge reaches every employee.

Secondly, with regard to intergenerational knowledge transfer, the results of the present study suggest that at least within teams, knowledge is “naturally” transferred more frequently from older to younger employees. As this is a linear effect, the positive intergenerational effect also works for smaller age differences, so that retiring employees should also share more with “middle-aged” colleagues. But, as mentioned above, the effect we found was rather weak. Therefore, the increased intergenerational knowledge transfer is probably not sufficient to prevent the loss of knowledge when an older employee retires. Nevertheless, the natural occurring intergenerational knowledge transfer helps reduce the threat of knowledge loss and can be a good starting point for further steps and measures that can be taken.

### 3.6.6. Limitations

The present study has some limitations that should be noted. First of all, we only examine knowledge transfer within teams. Of course, there may also exist intergenerational knowledge transfer beyond the border of the team, for example, older employees can pass on knowledge to younger colleagues in mentoring relationships or within the framework of cooperations
between different teams and units. Unfortunately, based on our data, we cannot draw any conclusions about this kind of transfer. More generally, the generalizability is limited since data were collected from different branches of a German public administration. Accordingly, our sample might not be representative for all types of organizations, and results might look different for a company sample. In addition, due to the cross-sectional design, inferences cannot be made about the direction of effects.

Furthermore, our operationalization of accumulated experience and knowledge in the form of team tenure could be improved. According to Tesluk and Jacobs (1998), experience has a quantitative (i.e., time-based) as well as a qualitative dimension (e.g., variety and breadth of tasks and responsibilities), and tenure captures only one of these dimensions. But, as the authors denote, the aspects that make up the qualitative dimension differ from one job to another and is, thus, hard to capture when the sample comprises different job profiles. Therefore, most researchers rely on tenure, an example that was followed in the present study.

Moreover, we only investigated the frequency of knowledge transfer, i.e., the quantity. Quality of knowledge transfer, for example the usefulness of the knowledge transferred (Constant et al., 1996) or transfer of explicit versus tacit knowledge (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka & von Krogh, 2009) was neglected in this study in favor of a simpler approach manageable in the round-robin / sociometric design. Although the frequency of transfer is definitely an important aspect of (intergenerational) knowledge transfer, it might be the case that age-related effects become more visible when looking at the quality of transfer. To test for such age-related effects on the quality of knowledge transfer would be an interesting perspective for future research. For the prevention of knowledge loss, surely, quantity as well as quality of transfer are important.

Finally, we have proposed several constructs that potentially convey the effects of age on knowledge transfer, e.g., generativity or OCB. Although we have measured the construct of
experience (operationalized as team tenure) and tested the respective influence on knowledge transfer, it would surely have been a more rigorous approach to measure all of these constructs directly. But as they were quite numerous, and as the investigation of the mechanisms by which age exerts its effects at the different levels was not the main objective of this study, we decided to limit the study to the investigation of experience effects at the dyadic and individual level.

3.6.7. Future research directions

Several research issues that might be interesting for the future have already been mentioned along these lines. More broadly, we suggested further theoretical development and empirical tests related to antecedents and outcomes of intergenerational knowledge transfer, and further investigation of dyad level predictors of knowledge transfer. On a more concrete note, we proposed a direct test of the mechanisms conveying the age effects found at the different levels as well as an investigation of effects on more qualitative aspects of knowledge transfer.

Beyond these topics, it might be interesting to look at knowledge transfer from younger to older employees. Against the background of demographic change and the threat of knowledge loss, the focus of the present study was on older employees and why they should transfer more knowledge to younger colleagues. But the opposite direction of transfer might be very interesting as well (Tempest, 2003). Younger employees, for example recent university graduates, might have knowledge that is more up to date and that covers recent developments in the field which have not yet reached (older) employees in the organizations. In such situations, the transfer of knowledge from younger to older employees can be very valuable. Here it seems especially important to study possibilities to overcome the higher number of barriers this transfer is confronted with, such as power and hierarchy structures (Tempest, 2003).
3.7. Conclusion

The present study used a multilevel social network approach to test for age effects on knowledge transfer at the dyadic level (age difference between source and recipient), individual level (age), and team level (age diversity). Results supported that there is increased intergenerational knowledge transfer with a significant effect of age difference at the dyadic level, as well as an increase in knowledge transfer under conditions of age diversity. Furthermore, we found that the effect of age difference seems to be based on the difference in team tenure, which functioned as a proxy for experience. With respect to the threat of knowledge loss, these results show that, especially in an age-diverse team, older employees naturally share more knowledge with younger employees. But the effects found were small, and it cannot be expected that this natural increase in intergenerational knowledge transfer suffices to prevent knowledge loss. Rather, to this end, additional measures have to be taken.
3.8. References


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Intergenerational Knowledge Transfer in Work Teams: A Multilevel Social Network Perspective


Intergenerational Knowledge Transfer in Work Teams: A Multilevel Social Network Perspective


4. Preventing Knowledge Loss When Employees Expect to Leave: Effects of Expected Turnover on Knowledge Transfer and Interactions with Perceived Supervisor Support

This is the last of the three empirical chapters of the present dissertation. With this paper, I shift the focus from predictors of knowledge transfer to knowledge transfer in situations that bear a threat of knowledge loss for the organization. More specifically, I am looking at situations in which employees expect or intend to leave the organization. Ideally, this would be situations in which the employees’ knowledge is safeguarded against loss by increased knowledge transfer to other employees, but there is good reason to believe that employees in such situations are less inclined to share their knowledge with colleagues. Thus, with this paper, I examine if knowledge transfer in such situations is actually a preferable prevention strategy.

4.1. Abstract

The prevention of knowledge loss is a pressing issue in the era of the knowledge-based view of the firm (Grant, 1996, 1997), not only because of the large cohort of baby boomers now starting to retire, but also because turnover rates among the younger generations are on the rise. Increased knowledge sharing can be one strategy to counteract organizational or group knowledge loss prior to employees’ turnover. However, knowledge sharing is a discretionary behavior which can be encouraged, but hardly demanded of employees intending or expecting to leave the organization. The objective of the present work was to investigate the effects of voluntary turnover intention and expected involuntary turnover on employees’ knowledge sharing within teams, as well as to examine a buffering effect of perceived supervisor support.

5 I thank Torsten Biemann and Sven Voelpel, who will be co-authoring this paper upon publication, for their input and collaboration.
on the presumably negative relationships. Results of a cross-sectional survey study in three branches of a German public administration with N=281 participants revealed the hypothesized negative effect of expected involuntary turnover on knowledge sharing, but a positive effect of turnover intention. The influence of perceived supervisor support (PSS) was two-fold; beyond a direct positive effect on knowledge sharing, PSS buffered the negative relationship between expected involuntary turnover and knowledge sharing.

4.2. Introduction

The prevention of knowledge loss in situations where employees leave an organization is becoming more and more of an issue (Ashworth, 2006; Massingham, 2008). It has been long established that knowledge is one of the, if not the most important resource in organizations (Grant, 1996, 1997), and constitutes a basis for competitive advantage, especially when it is successfully applied, transferred, and newly created (Alavi & Leidner, 2001; Argote, Ingram, Levine, & Moreland, 2000; Argote & Ingram, 2000; Szulanski, 1996). Knowledge exists at different levels within the organization, e.g., at the individual, group, or organizational level (Davenport & Prusak, 1998; Nonaka, 1994), but primarily resides in the minds of individual employees (Alavi & Leidner, 2001; Davenport & Prusak, 1998; Nonaka, 1994). Accordingly, losing experienced and knowledgeable employees without retaining their knowledge can be very costly (Ashworth, 2006; DeLong, 2004; Massingham, 2008). Up to now, the literature on knowledge loss has mostly focused on veteran employees who are starting to leave the companies in large numbers as the baby boomer generation reaches retirement age (e.g., Ashworth, 2006; DeLong, 2004; Leibold & Voelpel, 2006). These veteran employees have oftentimes stayed in the same organization for most of their professional careers (e.g., D’Amato & Herzelfeldt, 2008; Lancaster & Stillman, 2002) and have gained decades of experience and knowledge which organizations cannot afford to lose.
Although the retention of retirees’ knowledge is an important aspect of preventing knowledge loss, other employee groups should not be neglected. Younger employees, for example recent university graduates, often have knowledge that is more up to date, and that covers recent developments in the field that have not yet reached the organizations. Furthermore, there is oftentimes a high degree of specialization in tasks, with the consequence that there are many experts, who can also be younger employees, who are the only organization or team members covering a certain field of knowledge. And there is actually a higher risk for younger employees’ knowledge to be lost to the organization, more specifically young professionals’ knowledge. First, in contrast to members of older generations, younger employees tend to be less willing to remain with the organization (D’Amato & Herzfeldt, 2008). Second, it has been shown that age is generally negatively related to the probability of changing a job (e.g., Campbell, 1997; Kidd, 1991, 1994), and third, turnover inclinations have been shown to increase with the level of education (Sousa-Poza & Henneberger, 2004). Taken together, young professionals seem to have a higher probability of leaving voluntarily than other employee groups. This shows that efforts to retain knowledge should not only target older, soon retiring employees, but should also focus on other groups of (younger) employees, especially those who are at risk of turnover.

One strategy to prevent knowledge loss is to encourage knowledge transfer between those leaving the organization and their successors or team members (Droege & Hoobler, 2003; DeLong, 2004; Leibold & Voelpel, 2006), and this before they actually leave (Droege & Hoobler, 2003). But, depending on the reasons for turnover, e.g., if it is voluntary or involuntary, employees might be less inclined to make an effort for the organization’s sake and, thus, less inclined to share their knowledge prior to leaving. Accordingly, to determine if knowledge transfer can be an appropriate strategy to prevent knowledge loss that works
efficiently prior to a potential employee turnover, we should examine the effect of different types of intended or expected turnover on knowledge sharing.

As the literature on turnover intention has mainly focused on causes of this phenomenon and on one very specific consequence, i.e., actual turnover (e.g., Mobley, 1977; Tett & Meyer, 1993; Zimmerman & Darnold, 2009), there is a considerable research gap with respect to other consequences. Moreover, influences on, and effects of the expectation of having to leave the organization are so far completely under-researched. Accordingly, for intended or expected turnover, effects on knowledge sharing are so far unknown, as are strategies to buffer potential negative effects. This is where we want to add to the literature.

In the present paper, taking a multi-theoretical approach drawing on social exchange theory (Blau, 1964), cognitive dissonance theory (Festinger, 1957), organizational support theory (Eisenberger, Huntington, Hutchison, & Sowa, 1986; Shore & Shore, 1995), and the strain-stressor model (Beehr, 1985; House, 1981), we want to empirically investigate how different types of turnover intention and expectations influence individual knowledge sharing, and furthermore propose that and test if negative effects can be buffered by perceived supervisor support. In doing so, we aim to contribute to the extant literature, first, by presenting important behavioral consequences of intended or expected turnover. Second, we aspire to strengthen the importance of the supervisor for knowledge sharing, and consequently for knowledge retention processes. Third, we aim to broaden the focus of knowledge prevention efforts to employee groups other than retirees.

4.3. Theoretical and Empirical Background

We will first describe why we assume a negative relationship between certain forms of turnover intention / expectation and knowledge sharing. In a next step, we will elaborate how
perceived supervisor support, in addition to potentially directly increasing knowledge sharing, could buffer this negative effect of turnover intention and expectation.

4.3.1. Intended or expected turnover and knowledge sharing

An important distinction that is made in the literature on actual turnover is the distinction between voluntary and involuntary turnover (Bluedorn, 1978; McElroy, Morrow, & Rude, 2001; Shaw, Delery, Jenkins, & Gupta, 1998). Voluntary turnover refers to employees leaving an organization of their own accord, with the employees initiating this separation, whereas involuntary turnover reflects a separation that is not initiated by the employees but by the employer (Bluedorn, 1978). This distinction can be applied to the situation prior to separation as well; there are employees who intend or expect to leave the organization of their own accord, and there are employees who expect that the organization will end the employment, e.g., because a fixed-term contract is ending or because the organization has to downsize. The former is called turnover intention and has been well researched, the latter, which is rather under-researched, we term “expected involuntary turnover”.

Turnover intention is defined as an employee’s desire or willingness to leave an organization (Thoresen, Kaplan, Barsky, Warren, & de Chermont, 2003). We posit that employees who intend to leave the organization are less inclined to engage in extra-efforts on the job and, thus, less inclined to share knowledge with their team colleagues, because sharing knowledge is costly for an employee in terms of time, effort, and energy (Constant, Sproull, & Kiesler, 1996; Goodman and Darr, 1998; Reagans and McEvily, 2003; Szulanski, 1996). Knowledge sharing is one of the behaviors involved in the process of knowledge transfer,

6 Leaving the organization due to retirement is also a form of involuntary turnover, but expected retirement is not subsumed under expected involuntary turnover here, as quite different relations to knowledge sharing might be assumed. Instead, it was measured separately. But as older employees and retirement were not the focus of the paper, we will only briefly refer to the construct and respective results in the discussion.
which is defined by Argote and Ingram (2000, p. 151) as “the process through which one unit (e.g., group, department, or division) is affected by the experience of another.” When we use the term knowledge sharing in the following, we refer to individual employees’ sharing knowledge with other employees, regardless of the form of knowledge, the communication channel used, or the initiating party of the transfer.

In the extant literature, we found several theoretical and empirical indications for the assumption of a negative relationship between turnover intention and knowledge sharing: The first indication stems from social exchange theory (Blau, 1964). Social exchange theory posits that in exchange for efforts on the job, such as sharing your knowledge with your colleagues, employees receive benefits from the organization (or the respective colleagues). And, according to social exchange theory, employees invest in such efforts because they will be reciprocated in the future. However, employees with high turnover intention wish to exit these exchange relationships in the near future. Thus, they cannot be sure that, if they put in extra-work, the organization will have a chance to repay these efforts. Accordingly, these employees should share less knowledge than those who do not intend to leave.

The second indication stems from theorizing and empirical findings on organizational citizenship behavior (OCB). OCB and knowledge sharing share some very similar characteristics: they are discretionary or voluntary behaviors that are beneficial for the organization, but that are not part of employees’ chore task performance and usually not recognized by the formal reward system (Organ, 1988; Chen, 2005; Chen, Hui, & Sego, 1998; Gagné, 2009). Thus, employees can withhold these behaviors without the experience of direct negative consequences from the organization (Chen, 2005; Chen et al., 1998). Chen and colleagues (1998) as well as Chen (2005) proposed a negative relationship between turnover intention and OCB, relying on cognitive dissonance theory (Festinger, 1957). Cognitive dissonance theory posits that people feel a certain discomfort when there are inconsistencies
between their attitudes, beliefs, or behaviors. This discomfort constitutes a motivational drive to reduce the inconsistencies that cause it. Chen and colleagues (1998) and Chen (2005) assume that cognitions about leaving the organization (turnover intention) and OCB (behaviors that express a positive attitude toward the organization) are inconsistent, and that the employee will seek to reduce this inconsistency. Building on the same theoretical basis, we suggest that turnover intention, as a negative attitude toward the organization, and knowledge sharing, as a behavior expressing a positive attitude toward the organization, are inconsistent, and that in order to reduce this inconsistency, employees with turnover intention will share knowledge less frequently.

The suggested negative relationship between OCB and turnover intention has been supported in several empirical studies (Chen, 2005; Chen et al., 1998; Coyne & Ong, 2007; Podsakoff, Blume, Whiting, & Posdakoff, 2009). Considering the similarities between OCB and knowledge sharing, Gagné (2009) proposed that they should be influenced by similar motivational factors. Thus, assuming that turnover intention motivates certain behaviors (and demotivates others), it can be assumed that if turnover intention empirically shows to be negatively related to OCB, this should also be the case for knowledge sharing. Based on the presented arguments, we thus propose:

**HYPOTHESIS 1: Turnover intention is negatively related to knowledge sharing.**

Turnover intention and expected involuntary turnover share certain similarities, but they also differ in certain aspects. Expected involuntary turnover is similar to turnover intention in that both constructs imply that employees do not expect to work for the organization in the future, are possibly looking for other jobs, and are disengaging from the organization. Thus, the theoretical arguments that have been presented above for the relationship between turnover intention and knowledge sharing should equally apply for the relationship between expected involuntary turnover and knowledge sharing. Employees who expect involuntary
turnover cannot be sure that their knowledge sharing will be reciprocated in the future, and
the expectation of being let go by the organization should be inconsistent with helping the
organization by sharing one’s knowledge.

On the other hand, expected involuntary turnover differs from turnover intention in that
the control over the end of employment does not lie in the hands of the employee, but in the
hands of the employer. Thus, expected involuntary turnover should often be accompanied by
job insecurity. Job insecurity is a job stressor (Ashford, Lee, & Bobko, 1989; Sverke,
Hellgren, & Näswall, 2002) which is defined as “perceived powerlessness to maintain desired
continuity in a threatened job situation” (Greenhalgh & Rosenblatt, 1984, p. 438). Job
insecurity leads to psychological and behavioral withdrawal from the job (Greenhalgh &
Rosenblatt, 1984; Staufenbiel & König, 2010; Sverke et al., 2002) and, thus, to negative job-
related reactions (Cheng & Chan, 2008; Greenhalgh & Rosenblatt, 1984). An example for
such reactions could be the reduction of knowledge sharing. Therefore, we assume that
expected involuntary turnover is negatively related to knowledge sharing and that, due to the
related job insecurity, it is actually more so than turnover intention. Accordingly, we posit:

HYPOTHESIS 2a: Expected involuntary turnover is negatively related to knowledge
sharing.

HYPOTHESIS 2b: The relationship between expected involuntary turnover and knowledge
sharing is more strongly negative than the relationship between turnover intention and
knowledge sharing.

The assumed negative relationship between the different forms of expected or desired
turnover and knowledge sharing makes it more difficult to use knowledge sharing as a
strategy to retain knowledge when people intending or expecting to leave actually do so. To
retain knowledge, such employees should ideally share more of their knowledge, not less.
Thus, the question that seems to impose itself upon us is: how can the negative effect of
turnover intention and expected involuntary turnover on sharing be buffered or, ideally, be reversed?

**4.3.2. Perceived supervisor support**

The relationship with the supervisor is thought to be one of the employee’s most important relationships (e.g., Manzoni & Barsoux, 2002; O’Driscoll & Beehr, 1994), and the supervisor’s influence on employee behavior has been studied extensively within the framework of leadership (Avolio, Reichard, Hannah, Walumbwa, & Chan, 2009), oftentimes in the form of such concepts as leader-member-exchange (Gerstner & Day, 1997) or perceived supervisor support (Rhoades Shanock & Eisenberger, 2006). Perceived supervisor support (PSS) is defined as the perception of leader behaviors that encourage and facilitate the employees’ work efforts (Babin & Boles, 1996). It can be seen as a form of perceived social or organizational support, which has been shown to buffer the negative effects of many different work stressors on strains, the former defined as adverse conditions in the work environment such as work overload or job insecurity, the latter defined as individual responses to stressors such as burnout (Rhoades & Eisenberger, 2002; Viswesvaran, Sanchez, & Fisher, 1999). Viswesvaran and colleagues (1999) demonstrated in their meta-analysis that the pattern of buffering effects of social support on the stressor-strain-relationship is the same independent of the type of stressor, the source of support, or the type of strain. Furthermore, they found that social support acts in a threefold manner, that is, it directly reduces the perceived strength of stressors and the felt strains, and it reduces the effects of stressors on strains (i.e., buffers these effects). If we consider turnover intention and expected involuntary turnover as stressors, and reduced knowledge sharing as a response to this stressor (i.e., a strain), PSS might have effects similar to those described by Viswesvaran and colleagues
Preventing Knowledge Loss When Employees Expect to Leave

(1999) on the relationship between the two forms of expected or intended turnover and knowledge sharing.

As the present study focuses on effects on knowledge sharing, a direct effect of PSS on turnover intention or expected involuntary turnover, the stressors in this model, is not of interest here. Nevertheless, it is worth noting that PSS has been shown to have a negative effect on voluntary turnover (Eisenberger, Stinglhamber, Vandenberghe, Sucharski, & Rhoades, 2002; Maertz, Griffeth, Campbell, & Allen, 2007). With respect to the present research question, we can assume that PSS has a positive effect on knowledge sharing. First, if we consider a reduction of knowledge sharing as a strain, then, following Viswesvaran and colleagues (1999), PSS should have a direct negative effect on this strain, i.e., should lead to more knowledge sharing. Second, social exchange theory, too, would suggest that PSS has a positive impact on knowledge sharing, as PSS, which is a form of perceived organizational support, should produce a felt obligation to help the organization reach its objectives (Rhoades & Eisenberger, 2002). The employee should seek to discharge this felt obligation through increased allegiance and extra performance efforts (Mossholder, Settoon, & Henagan, 2005), an example of which can be knowledge sharing. Third, the extant literature shows first support for such a relationship: Cabrera, Collins, and Salgado (2006) found that the perception of support from supervisors and coworkers had a positive effect on knowledge transfer. Furthermore, Bock, Lee, Zmud, and Kim (2005) found a positive relationship between subjective norms (measured as the normative beliefs that the CEO, boss and colleagues think that the person should share his/her knowledge as well as the motivation to comply to this normative beliefs) and intention to share knowledge. Finally, Zárraga and Bonache (2005) discovered a significant positive correlation between knowledge transfer and the extent to which a leader was involved in the work of the respective team and facilitated knowledge sharing. Therefore, we predict:
HYPOTHESIS 3: Perceived supervisor support is positively related to knowledge sharing.

Furthermore, Viswesvaran and colleagues’ (1999) findings on stressor-strain-support-relationships would suggest that PSS can buffer the negative effects of turnover intention and expected involuntary turnover on knowledge sharing behavior, i.e., the effects should be less negative. Moreover, such buffering effects can be expected on the grounds of social exchange theory: Even though the employee might feel that efforts such as knowledge sharing will not be returned in the future, PSS would create a feeling of obligation that has to be recompensed. And enabling a smooth transition for the succession process by sharing your knowledge might be one of the most salient ways of compensation. Therefore, we predict:

HYPOTHESIS 4: Perceived supervisor support moderates the relationships between turnover intention and knowledge sharing and expected involuntary turnover and knowledge sharing, respectively, in such a way that when perceived supervisor support is high, these relationships are less negative.

4.4. Method

4.4.1. Sample and data collection

The study was conducted at three branches of a German public administration. N=294 online-questionnaires were filled out by employees stemming from 66 teams. Two teams which formed subunits of another, larger team in the data sample had to be excluded to avoid the double inclusion of the same values twice. Seven teams with only one participant each were eliminated to avoid biased team-level estimation, e.g., of the control variable trust, due to non-response (Timmerman, 2005). Thus, the sample resulted in N=281 participants belonging to 57 teams. Participants had a mean age of 47.9 years (SD=9.2), a mean tenure of 15.2 years (SD=11.3), and a mean job experience of 12.3 years (SD=10.6). 54% of the sample was female, 25% of the participants were working part-time, and the mean within-team turnover
rate for the past year was 12.8%, i.e., on average, 12.8% of last year’s employees of each team had left within the past year. After an open information session, prospective participants received an email-invitation to take part in the study and had three weeks to fill in the online questionnaire. The 294 participants represent 58.0% of the originally contacted employees.

4.4.2. Measures
As the study was conducted in German, scales stemming from the English-speaking literature were translated into German, then independently back-translated into English and compared to the original version. Where there were inconsistencies, they were resolved by the translators (Brislin, 1980).

Independent variables. Turnover intention and expected involuntary turnover were measured with two related items based on a scale from Moore (2000): “In the coming year, I will probably look for a new job a) voluntarily, b) because my contract ends, due to business operation reasons…” Each of the two items a), measuring turnover intention, and b), measuring expected involuntary turnover, was to be rated on a 7-point Likert scale ranging from “very improbable” to “very probable”.

Perceived supervisor support (PSS) was measured specifically as perceived supervisor support for knowledge sharing. By choosing such a specific form of supervisor support, we matched the form of support and the behavior to be affected (Cohen & Wills, 1985). We did this in order to obtain a larger effect and to show the effect of a more concrete and applicable behavior. PSS was measured with two items built based on the scale used by Cabrera and colleagues (2006), and Maurer and Tarulli (1994), respectively, and focused on perceived facilitation, encouragement, and support for knowledge sharing: “My supervisor encourages and supports me in sharing my knowledge with team colleagues.” and “After completing a project or significant milestone, my supervisor encourages me to make my ideas and
experiences available to team colleagues.” The two items were answered on a 7-point Likert scale ranging from “completely disagree” to “completely agree”, and Cronbach’s $\alpha$ amounted to 0.92.

**Dependent variable.** In accordance with previous measurements of knowledge transfer as a frequency (Cummings, 2004; Kanhanhalli, Tan, & Wie, 2005), we measured knowledge sharing by asking participants to answer the following question on a 5-point Likert scale ranging from “very seldom” to “very often”: “How often have you shared knowledge with your team colleagues within the last three months?” The intraclass correlation coefficient ICC(1) as a measure of non-independence (Bliese, 2000) amounted to 0.07, indicating that knowledge sharing was influenced to a certain degree by group membership. Thus, a multilevel analysis should be used to analyze data.

**Control variables.** To rule out alternative explanations for variations in the frequency of knowledge sharing, we included several control variables in our analyses. Effects of independent variables were controlled for the sex, age, educational level (education), job experience, work contract (part-time or full-time), and intrinsic motivation for knowledge transfer of the employee, as well as for the effects of the size of the team and intragroup trust. Furthermore, an organization dummy was employed to control for effects of the different branches of the administration surveyed. Intrinsic motivation for knowledge transfer was measured with four items taken from the interest / enjoyment scale of the Intrinsic Motivation Inventory by Deci and Ryan (e.g. Deci, Eghrari, Patrick, & Leone, 1994; Ryan, Mims, & Koestner, 1983) and adapted to the context of knowledge transfer (items can be found in the Appendix). Answers were given on a 7-point Likert scale ranging from “completely disagree” to “completely agree”. Cronbach’s $\alpha$ for these four items amounted to 0.85. Intragroup trust was measured with five items taken from Simons and Peterson (2000) and adapted to the present context. Again, items, which can be found in the Appendix, were answered on a 7-
point Likert scale from “completely disagree” to “completely agree”, in this case with a Cronbach’s $\alpha$ of 0.93. Individual ratings of intragroup trust were aggregated to the team level, with a mean $r_{WG(J)}$ of 0.85 (Cohen, Doveh, & Eick, 2001; James, Demaree, & Wolf, 1984), an ICC(1) of 0.26, and ICC(2) of 0.75 (Shrout & Fleiss, 1979; McGraw & Wong, 1996), showing that there is sufficient agreement between team member ratings to justify aggregation.

4.4.3. Analytical strategy and statistical approach

In a first step, we conducted a missing variable analysis and filled missing data using the expectation-maximization (EM) algorithm (Dempster, Laird, & Rubin, 1977). The EM algorithm is an iterative process with two steps for each iteration; the first step computes expected values based on observed data and estimates from the last iteration, the second step provides maximum-likelihood estimates of the parameters in question based on values from the first step. Missing data were filled for independent as well as dependent variables following Graham’s (2009) recommendation that this produces less bias than listwise or pairwise deletion. We then computed simple descriptives and zero-order correlations, conducted ANOVAs to compute ICC(1)s, and calculated the $r_{WG(J)}$ for intragroup trust.

To test our hypotheses, we had to take into account that subjects who originate from different teams within an organization, as in the present sample, are nested within teams, with the consequence that data are non-independent (Bliese, 1998; Hoffman, 1997; Hox, 2002; Raudenbush and Bryk, 2002). If non-independence is not accounted for, standard errors are too small and results from regression-based statistics are biased. Employing the HLM 6.08 statistical package, we thus built the following two-level models to test our hypotheses: In a first step, we entered the control variables at the individual and team level (Model 1). These and all other variables were entered into the models centered around their grand mean. In a
second step, we introduced the independent variables turnover intention and expected involuntary turnover as well as PSS at the individual level to test Hypotheses 1 to 3 (Model 2).

To test Hypothesis 2b, i.e., if the relationship between expected involuntary turnover is more strongly negative than the relationship between turnover intention and knowledge sharing, we performed a contrast analysis for the respective coefficients in Model 2 (Enders & Tofighi, 2007; Hox, 2002). A contrast is a composite hypothesis on a set of parameters that postulates, for example, that parameters are equal. Contrasts are tested, automatically within HLM 6.08, with an asymptotic chi-square test (Hox, 2002; Raudenbush & Bryk, 2002; Tabachnick & Fidell, 2001). In our analysis, we tested the null hypothesis represented by the contrast $1 \times \text{coefficient for turnover intention} + (-1) \times \text{coefficient for expected involuntary turnover} = 0$.

To test Hypothesis 4, we created two alternative models to test the interaction between turnover intention and PSS (Model 3a), and expected involuntary turnover and PSS (Model 3b), respectively, by adding the respective interaction terms to Model 2. Following the recommendation by Echambadi and Hess (2007), we did not mean-center the constituent parts of the interaction term before entering it into the cross-product, as this procedure does not mitigate the collinearity problem as assumed by many researchers. To further probe significant interactions, we conducted simple slope tests for three values of supervisor support: 1 SD above the mean, the mean, and 1 SD below the mean (Aiken & West, 1991; Bauer & Curran, 2005; Preacher, Curran, & Bauer, 2006). To this end, we used the online tool “Simple Intercepts, Simple Slopes, and Regions of Significance in HLM 2-way Interactions” designed by Preacher, Curran, and Bauer, which is described in their article from 2006. The interactions were then graphed accordingly.
In order to check if the respective model could account for variance in the dependent variable, goodness of fit equivalent to the $R^2$ in regression statistics was calculated following a procedure suggested by Raudenbush and Bryk (2002). First, a one-way ANOVA model was computed in HLM with knowledge sharing as dependent variable. Then, the resulting values for $\sigma^2$ (within-group variance) and $\tau_{00}$ (between-group variance) from this baseline model were compared with the $\sigma^2$ and $\tau_{00}$ values from subsequent models in the following manner:

When individual-level predictors were added

$$R^2 = \frac{\bar{\sigma}^2(\text{baseline model}) - \bar{\sigma}^2(\text{extended model})}{\bar{\sigma}^2(\text{baseline model})},$$

(1)

and when team-level predictors were added

$$R^2 = \frac{\bar{\tau}_{00}(\text{baseline model}) - \bar{\tau}_{00}(\text{extended model})}{\bar{\tau}_{00}(\text{baseline model})}.$$  

(2)

4.5. Results

4.5.1. Descriptive results

Descriptive statistics can be found in Table 8 and Table 9, including means, standard deviations, reliabilities in case of scales, and zero-order correlations. Whereas Table 8 depicts descriptive statistics for the individual level control and independent variables, Table 9 covers the team level statistics for the three control variables at this level. Generally, zero-order correlations should be interpreted with caution here, since they do not take into account the non-independence of the data.
Table 8

Descriptive Statistics and Zero-Order Correlations for Individual Level Variables

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sex</td>
<td>1.54</td>
<td>0.50</td>
<td>281</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Age</td>
<td>47.86</td>
<td>9.43</td>
<td>281</td>
<td>-0.08</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Education</td>
<td>5.51</td>
<td>1.52</td>
<td>281</td>
<td>-0.14*</td>
<td>-0.03</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Experience</td>
<td>12.26</td>
<td>10.55</td>
<td>281</td>
<td>0.46***</td>
<td>-0.13*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Full-time</td>
<td>2.71</td>
<td>0.51</td>
<td>281</td>
<td>-0.42***</td>
<td>-0.09</td>
<td>0.11†</td>
<td>-0.09</td>
<td>-</td>
<td></td>
<td></td>
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<tr>
<td>6.</td>
<td>Intrinsic Motivation</td>
<td>6.03</td>
<td>0.92</td>
<td>281</td>
<td>0.20**</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.03</td>
<td>-0.17**</td>
<td>0.85</td>
<td></td>
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<tr>
<td>7.</td>
<td>Turnover Intention</td>
<td>1.57</td>
<td>1.37</td>
<td>281</td>
<td>-0.15*</td>
<td>-0.20**</td>
<td>0.16**</td>
<td>-0.13*</td>
<td>0.03</td>
<td>-0.16**</td>
<td>-</td>
<td></td>
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<tr>
<td>8.</td>
<td>Expected Inv. Turnover</td>
<td>1.17</td>
<td>0.82</td>
<td>281</td>
<td>-0.10†</td>
<td>-0.21***</td>
<td>0.03</td>
<td>-0.08</td>
<td>0.11†</td>
<td>-0.02</td>
<td>0.24***</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>PSS</td>
<td>4.95</td>
<td>1.55</td>
<td>281</td>
<td>-0.08</td>
<td>0.04</td>
<td>0.07</td>
<td>0.03</td>
<td>0.17**</td>
<td>0.24***</td>
<td>-0.17**</td>
<td>-0.09</td>
</tr>
<tr>
<td>10.</td>
<td>Knowledge Sharing</td>
<td>3.84</td>
<td>1.00</td>
<td>281</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.02</td>
<td>0.11†</td>
<td>-0.02</td>
<td>0.22***</td>
<td>0.02</td>
<td>-0.10†</td>
</tr>
</tbody>
</table>

Note. Cronbach’s alphas in the diagonal.

*Sex coded as 1 = male, 2 = female. Full-time coded as 1 = part-time contract less than 20hrs/week, 2 = part time employment, 20hrs/week, 3 = full-time employment.

†p < .10. *p < .05. **p < .01. ***p < .001.
### Table 9

**Descriptive Statistics and Zero-Order Correlations for Team Level Variables**

<table>
<thead>
<tr>
<th></th>
<th>Size</th>
<th>Trust</th>
<th>Organization Dummy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M</strong></td>
<td>8.25</td>
<td>5.13</td>
<td>1.61</td>
</tr>
<tr>
<td><strong>SD</strong></td>
<td>4.12</td>
<td>0.85</td>
<td>0.88</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>57</td>
<td>57</td>
<td>57</td>
</tr>
</tbody>
</table>

1. **Sex**<sup>a</sup>  
   -0.07  0.24<sup>†</sup>  0.47***

2. **Age**  
   -0.00  0.17  0.38**

3. **Education**  
   -0.13  -0.20  -0.15

4. **Experience**  
   0.24  0.19  0.43**

5. **Full-time**<sup>b</sup>  
   -0.03  -0.26<sup>†</sup>  -0.48***

6. **Intrinsic Motivation**  
   -0.02  0.50***  0.22<sup>†</sup>

7. **Turnover Intention**  
   0.02  -0.28*  -0.30*

8. **Expected Inv. Turnover**  
   0.19  -0.18  -0.26*

9. **PSS**  
   0.12  0.10  0.09

10. **Knowledge Sharing**  
    0.17  0.49***  0.24<sup>†</sup>

11. **Size**  
    -  -0.18  0.13

12. **Trust**  
    -0.18  0.93  0.27*

13. **Organization Dummy**  
    0.13  0.27*  -

**Note.** Team level correlations between the three team level controls and other variables. Cronbach’s alphas in the diagonal.

- Sex coded as 1 = male, 2 = female.
- Full-time coded as 1 = part-time contract less than 20hrs/week, 2 = part time employment, 20hrs/week, 3 = full-time employment.

<sup>†</sup><i>p < .10</i>.  
<sup>*</sup><i>p < .05</i>.  
<sup>**p < .01</sup>.  
<sup>***p < .001</sup>.  

### 4.5.1. Hierarchical linear modeling

Results of the hypotheses tests are presented in Table 10, with Model 1 through Model 3b presenting the relationships between control variables and knowledge sharing, direct
relationships between independent variables and knowledge sharing, and the relationship between the two turnover-supervisor support interaction terms and knowledge sharing.

As shown in Model 1, there was a positive relationship between knowledge sharing and intrinsic motivation ($\gamma = 0.21, p = 0.001$), which decreased in size when other variables were added in subsequent models, but remained to be significant. Furthermore, intragroup trust was positively related to knowledge sharing ($\gamma = 0.25, p < 0.000$), again representing an important association that was supported across all models analyzed. In a similar manner, a positive relationship between team size and knowledge sharing could be shown across all models, though it was not as strong as the former ($\gamma = 0.03, p = 0.003$). Finally, there was a tendency for a positive relationship between job experience and knowledge sharing ($\gamma = 0.01, p = 0.099$). The variance explained by the different models, at the individual and team level as well as overall variance explained, can be found in Table 11.

Model 2 displays the results for the tests of Hypotheses 1 to 3. Hypothesis 1 suggested a negative relationship between turnover intention and knowledge sharing. This hypothesis was not supported, as the relationship was found to be positive ($\gamma = 0.09, p = 0.004$). Hypothesis 2a, on the other hand, was supported, as the relationship between expected involuntary turnover and knowledge sharing was found to be negative ($\gamma = -0.15, p = 0.003$). Hypothesis 2b was supported as well. Contrast analysis revealed that the coefficients for turnover intention and expected involuntary turnover differed significantly from each other ($\chi^2 = 17.79, p = 0.000$). As the coefficient for expected involuntary turnover was negative, while the coefficient for turnover intention was positive, we can, thus, conclude that the relationship between expected involuntary turnover and knowledge sharing is more strongly negative than the relationship between turnover intention and knowledge sharing. PSS was shown to be positively related to knowledge sharing ($\gamma = 0.20, p < 0.000$), which confirmed our
proposition made in Hypothesis 3. Again, the amount of variance explained by Model 2 can be found in Table 11.

In Hypothesis 4, we predicted interactions between the two forms of intended and expected turnover and PSS in such a way that, when PSS was high, the negative relationship between the respective form of intended/expected turnover and knowledge sharing would be less strong, i.e., buffered. Although Model 2 did only show a negative relationship between expected involuntary turnover, but not turnover intention and knowledge sharing, we tested for both interaction effects. Model 3a depicts the results for the interaction between turnover intention and PSS, which was not significantly related to knowledge sharing. Thus, with the interaction coefficient not being significant, we did not further probe simple slopes (Aiken & West, 1991; Bauer & Curran, 2005; Preacher et al., 2006). In Model 3b, the results for the interaction between expected involuntary turnover and PSS are given. The interaction term showed to be (positively) related to knowledge sharing ($\gamma = 0.08, p = 0.001$). To examine this interaction further, we graphed it for high (mean plus one standard deviation, SD), middle (mean), and low levels (mean minus one SD) of PSS. As can be seen in Figure 5, the negative relationship between expected involuntary turnover and knowledge sharing was strongest when PSS was low, was still negative when PSS was medium, and was close to zero when PSS was high. Simple slope tests revealed that slopes were significant for low and medium, but not for high PSS. Thus, Hypothesis 4 received support when expected involuntary turnover but not when turnover intention was considered. The variance explained by Model 3a and 3b can again be found in Table 11.
Table 10

**Hierarchical Linear Models for Knowledge Transfer**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3a</th>
<th>Model 3b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \gamma ) (SE)</td>
<td>( \gamma ) (SE)</td>
<td>( \gamma ) (SE)</td>
<td>( \gamma ) (SE)</td>
</tr>
<tr>
<td><strong>Individual Level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex(^a)</td>
<td>-0.17 (0.14)</td>
<td>-0.14 (0.14)</td>
<td>-0.13 (0.14)</td>
<td>-0.18 (0.13)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.01 (0.01)</td>
<td>-0.00 (0.01)</td>
<td>-0.00 (0.01)</td>
<td>-0.01 (0.01)</td>
</tr>
<tr>
<td>Education</td>
<td>0.01 (0.03)</td>
<td>0.01 (0.03)</td>
<td>0.01 (0.03)</td>
<td>0.01 (0.03)</td>
</tr>
<tr>
<td>Experience</td>
<td>0.02 (0.12)</td>
<td>-0.07 (0.12)</td>
<td>-0.07 (0.12)</td>
<td>-0.07 (0.12)</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>0.21** (0.06)</td>
<td>0.14* (0.06)</td>
<td>0.15* (0.06)</td>
<td>0.15* (0.06)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turnover Intention</td>
<td>0.09** (0.03)</td>
<td>-0.04 (0.11)</td>
<td>0.09** (0.03)</td>
<td></td>
</tr>
<tr>
<td>Expected Involuntary</td>
<td>-0.15** (0.05)</td>
<td>-0.15** (0.04)</td>
<td>-0.52*** (0.14)</td>
<td></td>
</tr>
<tr>
<td>Turnover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSS</td>
<td>0.20*** (0.04)</td>
<td>0.14** (0.05)</td>
<td>0.09* (0.05)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Size</td>
<td>0.03** (0.01)</td>
<td>0.03** (0.01)</td>
<td>0.03** (0.01)</td>
<td>0.03* (0.01)</td>
</tr>
<tr>
<td>Trust</td>
<td>0.25*** (0.06)</td>
<td>0.25*** (0.06)</td>
<td>0.25** (0.06)</td>
<td>0.25** (0.07)</td>
</tr>
<tr>
<td>Organization dummy</td>
<td>0.00 (0.09)</td>
<td>-0.01 (0.09)</td>
<td>-0.01 (0.09)</td>
<td>-0.00 (0.09)</td>
</tr>
</tbody>
</table>

*Note. All variables grand-mean centered.*

\(^a\)Sex coded as 1 = male, 2 = female. \(^b\)Full-time coded as 1 = part-time contract less than 20hrs/week, 2 = part time employment, 20hrs/week, 3 = full-time employment.

\(^\dagger\)\(p < .10\). \(^\ast\)p < .05. \(^\ast\ast\)p < .01. \(^\ast\ast\ast\)p < .001.
Table 11

Variance Explained (in Equivalence to $R^2$) by the Different Models

<table>
<thead>
<tr>
<th>Level</th>
<th>Model 1 (%)</th>
<th>Model 2 (%)</th>
<th>Model 3a (%)</th>
<th>Model 3b (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>3.80%</td>
<td>17.08%</td>
<td>17.22%</td>
<td>18.76%</td>
</tr>
<tr>
<td>Team Level</td>
<td>83.67%</td>
<td>10.43%</td>
<td>9.86%</td>
<td>7.77%</td>
</tr>
<tr>
<td>Overall (sum)</td>
<td>8.50%</td>
<td>16.56%</td>
<td>16.67%</td>
<td>17.97%</td>
</tr>
</tbody>
</table>

Note. Percentage of variance explained at the respective level, explained overall variance in brackets.

Figure 5. Interaction between expected involuntary turnover and perceived supervisor support for knowledge sharing (PSS). Low and high expected involuntary turnover represent the lower and upper observed value; low, medium, and high PSS represent the values of mean + 1SD, mean, and mean – 1SD (all following suggestions by Preacher et al., 2006).

4.6. Discussion

In the present study, we addressed the relationship between two forms of intention or expectation to leave the company and knowledge sharing behavior. For expected involuntary turnover, we found a negative effect on frequency of knowledge sharing, but this effect was buffered by PSS, which also had a direct positive effect on knowledge sharing. For turnover
intention, however, we did not find a negative but a positive effect on frequency of sharing knowledge. Here, PSS did not have a moderating influence. These results have implications for theory as well as for practice, which will be discussed in the following.

4.6.1. Theoretical implications

First of all, the results of the present study demonstrate that turnover intention does not only predict actual turnover (Mobley 1977; Mobley, Griffeth, Hand, & MeGlino, 1979; Steers & Mowday, 1981), but that the intention to voluntary (as well as the expectation to involuntary) leave also has very specific behavioral consequences. As noted by Fishbein and Ajzen (1975), intentions toward an act or behavior are distinct from that act or behavior itself. And, based on our results, we propose that they can have other consequences as that act or behavior as well, and therefore merit more consideration and investigation.

Moreover, results show that the well established distinction between voluntary and involuntary turnover (Gupta & Jenkins, 1991; Hulin, Roznowski, & Hachiya, 1985; Shaw et al., 1998) is not only relevant when actual turnover is considered, but also prior to the actual leaving of the organization, that is, at a point when voluntary turnover is only intended or a future involuntary turnover is expected. Typically, in the literature, the distinction is made to investigate precursors and predictors of turnover, such as HR strategies (Shaw et al., 1998), to investigate the relationship between performance and turnover, pursuing questions like whether voluntary turnover harms the organization and whether the right ones are let go (Wells & Muchinsky, 1985), or to investigate effects of different forms of turnover on subunit performance (McElroy et al., 2001). We have extended this distinction to turnover intention and expectation. Results have shown that when employees concern themselves with leaving the organization and looking for a new job, it makes a difference if employees have the choice to do so – or not. When employees think about leaving, but it is within their own control, they
behave very differently with respect to knowledge sharing than when they expect to be forced to go. This is an important addition to the literature.

Furthermore, the finding that turnover intention had a positive effect on knowledge sharing was surprising, and it merits further reflection and investigation. Several possible explanations for this result can be thought of. One explanation is that there is a variety of reasons why employees intend to leave, and eventually voluntary leave, and not all of them are associated with the organization. Reasons might be a more attractive job offer, the wish for further education or a change of profession, health reasons, or family commitments (Dalton, Krackhardt, & Porter, 1981; McElroy et al., 2001). Mobley (1982) made the distinction between push and pull factors for turnover, whereas Dalton and colleagues (1981) differentiated between controllable versus unavoidable turnover. It might be the case that in the present study, employees were mainly intending to leave due to pull factors or unavoidable reasons that are not related to the organization. When employees have been treated well by the organization and are satisfied with their job, but are for other reasons thinking about leaving, they might actually have “a bad conscience”, and might want to relief it through some form of compensation. Social exchange theory, for example, would posit that employees might even feel an obligation to show extra efforts as they will cause the organization a lot of costs with their voluntary turnover. Thus, employees with higher turnover intention might, depending on the reasons for their intention, share more knowledge. Accordingly, future studies might want to specify in a more detailed manner not only if employees intend to leave (or if they expect to leave involuntarily), but furthermore why they want to leave, differentiating between push and pull factors.

On a different note, our results strengthen the importance of supervisors in teams and yield direct support for supervisors’ influence on their subordinates’ knowledge sharing. Whereas other studies (Bock et al., 2005; Cabrera et al., 2006; Zárraga & Bonache, 2005)
rendered indirect support for this relationship by testing the influence of support from colleagues and supervisors, beliefs that the boss is in favor of knowledge sharing, or the involvement of a leader in a work team on knowledge transfer, we tested and found a direct influence of PSS on knowledge sharing. Furthermore, this is in line with Rhoades Shanock and Eisenberger’s (2006) finding that PSS has a direct influence on in-role and extra-role performance, in such that knowledge sharing could be interpreted as a form of extra-role performance.

The supervisor’s influence is two-fold, however: PSS did not only have a positive effect on the frequency of sharing knowledge, but it also buffered the negative effect of expected involuntary turnover on knowledge sharing. This is in line with Viswesvaran and colleagues’ (1999) findings on social support and strengthens the importance of the supervisor for fostering positive employee behaviors, including knowledge sharing. The supervisor’s influence is not only important in day-to-day business, but especially when specific circumstances arise that might strain the employee and lead to unfavorable behaviors, e.g., withdrawal or reduction in knowledge sharing. Whereas in the support literature, it is usually the broader concept of organizational support that is studied, the present study shows that also very specific forms of support, such as PSS for knowledge sharing, have important, if not even stronger effects. Moreover, PSS and very specific forms of PSS seem to be interesting concepts to study the supervisor’s influence beyond general leadership styles, which are predominant in the literature.

Last but not least, with the present study we broadened the focus of knowledge loss literature and considerations. In the extant literature, the need to prevent knowledge loss usually addresses the knowledge of older employees who will soon retire (e.g. DeLong, 2004; Leibold & Voelpel, 2006). Of course, this is an important issue and probably right now the most pressing one with respect to knowledge retention. Therefore, we did not completely
neglect this issue in the present study. Although we did not report any hypotheses or results above, we did also test the relationship between the expectation to retire within the next year and knowledge sharing, as well as a possible moderating role of PSS. Results were similar to those reported for expected involuntary turnover: there was a negative direct effect of expected retirement on knowledge sharing, but this negative effect was buffered by PSS. Although these seem to be interesting results which merit attention, above all because intuitively, one might expect soon-retiring employees to rather share more knowledge, we took a conscious decision to focus on employees at all stages of their career, and not narrow the sample down to retiring employees. We think that, especially in the long run, it will be essential to not just address retiring employees when dealing with knowledge retention, but to include other employees, i.e., all kinds of employees with valuable knowledge, as well. With the present study, we made a first step toward unveiling this risk for knowledge loss posed by other employee groups. The prevention of knowledge loss should address all kinds of employees, with retaining retirees’ knowledge as one special case out of many.

4.6.2. Practical implications

For practitioners, the results of the present study bear good news. Turnover intention, which can be very destructive as employees sometimes leave rather unpredictably without much prior notice, does not seem to have negative consequences for knowledge sharing. Thus, even if employees intend to leave, and might leave on short notice, they seem to be willing to share what they know. It could be expected that, as they do not reduce knowledge sharing within their own team, they would also be open for other retention processes, such as debriefings, so that a lot of their knowledge can be transferred to team colleagues or made accessible for potential successors.
In contrast to turnover intention, expected involuntary turnover does seem to have very negative consequences for knowledge sharing and might, thus, put the organization at a risk of losing knowledge. But, again in contrast to voluntary turnover, involuntary turnover is decided on by the organization, and is therefore very predictable. Accordingly, measures can be taken to counteract employees’ withdrawal from knowledge transfer processes, and the risk of knowledge loss can be reduced. As the results of this study show, one measure against withdrawal from knowledge sharing is PSS, specifically PSS for knowledge sharing. Losing one’s job can constitute a threat to a person’s sense of value and worth (Schneer, 1993). But when supervisors assure that the employees’ knowledge is needed and valued, they can counteract this impression. Thus, although involuntary turnover can have negative consequences (and this even before it takes place), these consequences can be prevented through positive involvement of the supervisor.

4.6.3. Limitations

There are certain limitations to the present study that should be noted when interpreting the results. First of all, we only studied knowledge sharing within teams. Of course, it might well be that employees who intend or expect to leave the organization are sharing their knowledge with other people outside their team, or they might try to document it in writing and thereby retain it for the organization. In these cases, knowledge sharing within the team, which is what we measured, might still be the same or even lower, but this would not necessarily mean that the employees’ knowledge is at risk of being lost. Furthermore, we only measure the frequency, i.e., quantity of knowledge sharing, but not the quality or different types of knowledge, such as tacit and explicit knowledge (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka & von Krogh, 2009). When employees are expecting to leave the organization, they can withdraw from knowledge sharing either by reducing the quantity or the quality of
knowledge sharing, or both. They might actually rather choose to reduce the quality, as this would be less noticeable than reducing the quantity, and might, therefore, draw fewer consequences. Again, this would pass unnoticed in the present study, but surely merits further investigation.

Generally, the operationalization of constructs in the present study constitutes a limitation. Expected or intended turnover, PSS, and knowledge sharing were all operationalized via self-reports, and the scales employed were very parsimonious, measuring constructs with only one or two items. First, using only one measurement source can entail common method bias that can inflate or deflate the estimations of relationships between constructs (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). To control common method bias, we took several steps recommended by Podsakoff and colleagues (2003) when designing the study’s procedure: we protected respondents’ anonymity and reduced evaluation apprehension as much as possible. Furthermore, we improved scale items by clarifying key concepts, such as knowledge sharing, in information sessions prior to the study, which reduced ambiguity, and by using different scale endpoints and formats for predictor and outcome measures. Second, using very short scales may result in low reliabilities and in a reduction of effect sizes. On the other hand, measurements with few or even single-items have been shown to be reliable for many constructs, for example, job satisfaction and job effectiveness (Wanous & Hudy, 2001), or knowledge transfer (Kankanhalli et al., 2005; Watson & Hewett, 2006; Zárraga & Bonache, 2005). Indeed, we obtained satisfactory reliabilities and were able to demonstrate significant effects of the independent on the dependent variables, in spite of the rather short scales.

Moreover, the generalizability of the present study is limited. As our sample consisted of three different branches of a German public administration, we cannot rule out that results
might have looked different had we collected at a company sample, or had we conducted the study in a different cultural context.

Furthermore, the study had a cross-sectional design, which also entails certain limitations. First, we cannot draw any conclusions about the direction of effects found. It might well be that the negative relationship between expected involuntary turnover and knowledge sharing runs contrary to what we proposed; possibly, those employees who do not share much knowledge, e.g., because they are not very good performers and not very knowledgeable, are those whose contracts are not prolonged, who are fired, or released into retirement earlier than others, and those who are excellent performers and have a lot to share are the ones looking for new challenges outside the organization. Furthermore, what we interpret as a buffering effect of PSS might be explained likewise: those who do perform well and have valuable knowledge to share, but are still forced to leave the organization, e.g., because there is no money to continue their contracts, might receive supervisor support to share their knowledge with colleagues. An alternative explanation was suggested by Chen and colleagues (1998) for the negative relationship between turnover intention and OCB; the authors perceived turnover intention to be the attitudinal, and a reduction in OCB the behavioral indication of a third variable, namely withdrawal. Similarly, it is possible that expected involuntary turnover and knowledge sharing are influenced by a third variable, and thus coincide as a consequence of another factor. This should be further investigated in longitudinal studies that additionally collect data on potential third variables, such as performance or job satisfaction.

Moreover, collecting data at only one point in time meant having to decide on a fixed time frame for past knowledge sharing and intended / expected turnover in the future. We decided to measure knowledge sharing within the past three month, and compared it to the expectation to leave the organization within the next year. As we do not know at which point in time employees intending or expecting to leave start to withdraw from their job, the time
span chosen might have been too long. It might be that a reduction in knowledge sharing starts only when intentions are already strong and concrete, or when employees know they will be let go. If the time frame chosen was too large, this might have significantly decreased our estimation of relationships.

4.6.4. Future directions

Some directions for future research have already been mentioned, such as looking at the effect of intended / expected turnover on quality of knowledge sharing, e.g., by investigating the sharing of different types of knowledge, or applying a longitudinal study design to the research question at hand. Furthermore, it would be interesting to differentiate between effects of different reasons for turnover intention and expected voluntary turnover. McElroy and colleagues (2001) called for a separation between voluntary and different forms of involuntary turnover (i.e., dismissals and reduction in force) in studies at the organizational or subunit level. Similarly, we would suggest to investigate, at the individual level, the effect on knowledge sharing of different reasons for turnover intention (e.g., differentiating between different push and pull factors) and reasons why involuntary turnover is expected (e.g., end of a fixed-term contract vs. fear of being fired).

Moreover, taking a broader perspective on the topic of knowledge loss and its prevention, there is a wealth of strategies other than knowledge transfer within teams that can be employed, but that have not been empirically investigated yet. The research questions that are most pressing here are: First, which ones of these strategies, including knowledge transfer within teams, can really reduce the risk of knowledge loss, and, second, which one of these strategies is most effective or efficient under which conditions. The present study is only a very first step in the direction of this very important, but heavily under-researched area. To be able to answer questions with respect to the prevention of knowledge loss, there remains a lot
to be clarified, for example, how knowledge loss can actually be measured and operationalized. Thus, this is a promising direction for future research.

4.7. Conclusion

With the present study, we have shown that knowledge sharing does not necessarily decrease when employees intend to leave their organization, but rather, it seems to increase. And even when people expect to have to leave their organization, due to the end of their work contract, because the organization has to downsize, or because they fear to be let go, the frequency of knowledge sharing can be kept at a reasonable level when employees feel supported by their supervisors. Thus, it seems that knowledge transfer has the potential to work as a strategy against knowledge loss – however, it certainly cannot stand alone, and has to be flanked by other measures.
4.8. **References**


Preventing Knowledge Loss When Employees Expect to Leave


4.9. Appendix

Items for intrinsic motivation for knowledge transfer

To exchange knowledge with other team members…

1. … is fun.
2. … is interesting.
3. … is enjoyable.
4. … is rather boring and arduous. (reverse coded)

*Items were answered on a 7-point Likert scale ranging from 1= “completely disagree” to 7 = “completely agree”.*

Items for intergroup trust

In our team,…

1. …we absolutely respect each other's competence.
2. …every team member shows absolute integrity.
3. …we expect the complete truth from each other.
4. …we are all certain that we can fully trust each other.
5. …we count on each other to fully live up to our word.

*Items were answered on a 7-point Likert scale ranging from 1= “completely disagree” to 7 = “completely agree”.*
5. General Discussion

In the previous three chapters, the empirical work that has been done within the framework of this dissertation has been presented, and the respective findings have been discussed. In this last chapter, the goal is to discuss, at a broader level, how the results of the three papers relate to each other as well as general limitations of this dissertational work, to critically examine to what extent the objectives of the dissertation have been reached, and what we can derive for future directions of research. I will conclude this chapter by discussing the relevance of this dissertation for and contributions to the research field.

5.1. Recurrent Issues Across Papers

So far, the findings of the single papers have only been discussed separately. In the following, I will abstract from the single papers and focus on recurrent and striking results of the dissertation as a whole, such as important predictor variables (5.1.1.), distinctions to be taken into account in knowledge transfer research (5.1.2.), and the necessity of multilevel research (5.1.3.).

5.1.1. Important predictor variables: Age and intrinsic motivation

Two of the constructs investigated as predictors of knowledge transfer in the three papers merit a short discussion: First, age as an influencing factor that is rather new in this context, such that it has not been considered as a predictor in previous research, but is increasingly important due to the changing age structure in organizations; and second, intrinsic motivation, a potent influencing factor that strongly influenced knowledge transfer and seems to be one of the few consistently found predictors.

First, the effect(s) of age: Clearly, one of the foci of this dissertation was the study of age effects on knowledge transfer, owing to the framing within the context of knowledge loss and
the demographic change. Accordingly, age acted as an independent variable in the first study, as the key predictor (at different levels) in the second paper, and was controlled for in paper three, where the focus was a slightly different one. In paper one and two, similar results were found such that there were age effects on knowledge transfer, but that these effects were rather small. A difference between results between the two papers appeared with respect to the persistence of age effects when proxies for experience were introduced: In the first study, age effects persisted when job experience was controlled for, in paper two, they disappeared when team tenure was entered in the model. In the third paper, however, where age was used as a control at the individual level, no effects were found. Thus, although we can conclude that age effects do seem to exist, at least at certain levels, the question might arise if it really makes sense to study age effects on knowledge transfer, given that the effects I found were small and might simply be grounded in differences in experience. My answer would still be: Yes! The reason why I chose to study age was not because it seemed the best explanatory variable, but because the age structure of the workforce is changing, and we therefore need to know how this will affect knowledge transfer. Thus, we have to look for age effects, knowing that what we are examining might actually be a conglomerate of different age-related effects, as portrayed in chapter three.

Second, a prevalent predictor in this dissertational work was intrinsic motivation. This construct was introduced due to one of the research aims being to find major predictors of knowledge transfer. Intrinsic motivation appeared to be a good candidate as the long tradition of psychological research had shown it to be linked to behaviors in all kinds of domains, among them school, sports, and work (Deci & Ryan, 1985; Gagné & Deci, 2005; Hackman & Oldham, 1980). Furthermore, there had been some theoretical (Gagné, 2009; Osterloh & Frey, 2000) as well as empirical work (Cross & Sproull, 2004; Jarvenpaa & Staples, 2000; Kankanhalli, Tan, & Wie, 2005; Lin, 2007; Wasko & Faraj, 2000) relating intrinsic
motivation to knowledge transfer (sometimes in the form of propensity to share, enjoyment, or intrinsic benefit of sharing). Thus, in the first study, intrinsic motivation was employed as an independent variable, in the third paper it was used as a control – and had, in both cases, a strong effect on the knowledge transfer behaviors under study. What is more, in the first paper, intrinsic motivation was the only predictor that influenced knowledge sharing and knowledge seeking in the same manner, and this at the individual and team level. Whereas results for other predictors in this paper suggested that predictors usually influence different knowledge transfer behaviors differently, and sometimes have different effects at different levels, intrinsic motivation resisted this conclusion. Results of the third paper only strengthen this view. Thus, considering effects reported in the extant literature as well as the findings from this dissertation, intrinsic motivation seems to be one of the few persistent, major influencing factors with respect to knowledge transfer behaviors, and should therefore be included, at least as a control, in future studies on knowledge transfer.

5.1.2. Separate analysis of two sets of roles and behaviors

Another important issue in this dissertation is the role of different agents and behaviors in knowledge transfer. In the first paper, the argument was made and supported that sharing and seeking knowledge, which represent two different knowledge transfer behaviors, are differently influenced by (most of the) predictor variables. This calls for a separate theoretical and empirical treatment of the two agents and the respective behaviors in future knowledge transfer research.

In spite of this my own recommendation, so it seems, I did quite the opposite by using knowledge transfer, a mean across a rating for sharing and a rating for seeking, as the unit of analysis in the second paper. Nevertheless, also in the second paper, the distinction between the two agents and their roles was considered, but in a slightly different manner. The unit of
analysis was dyadic knowledge transfer from one employee to another (e.g., employee A to employee B). But, and this is the key, the opposite direction of transfer, that is from B to A, was also considered. With the introduction of this variable, which was called knowledge reception, I did not only cover employee A’s sharing and employee B’s seeking, but separately took into account employee A’s seeking and employee B’s sharing, and thus included both “roles”, source and recipient, of each employee. The analyses of knowledge transfer and knowledge reception, more specifically the analysis of the variance distribution for these variables, yielded an interesting result with respect to the roles of source and recipient: whereas 11% of the variance in knowledge transfer was located at the individual level, it was only 5% in the case of knowledge reception. In other words, knowledge transfer (from A to B) is more influenced by characteristics of A than is knowledge reception (i.e., knowledge transfer from B to A). In still other words, characteristics of the source have more influence on knowledge transfer than characteristics of the recipient. This might be an explanation for why in the extant literature, knowledge sharing and the source of knowledge receive much more attention than knowledge seeking and the recipient of knowledge (e.g., Constant, Sproull, & Kiesler, 1996; Kankanhalli et al., 2005; Wasko & Faraj, 2005; Quigley, Tesluk, Locke, & Bartol, 2007; Reagans & McEvily, 2003); it should be easier to find significant effects focusing on the source.

This result notwithstanding, it should be kept in mind that 77% and 83% of the variance, respectively, were located at the dyadic level in paper two. Thus, it actually seems to be the interplay of the source’s and the recipient’s characteristics that are most relevant. Accordingly, it is not only important to consider sharing and seeking, or the source and the

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7 Although I might have run two separate analysis, one for A’s knowledge sharing, and one for B’s knowledge seeking instead of the analysis of knowledge transfer, I made a conscious decision not to do so: first, I would have lost the advantage of having a dependent variable that, being an average of two different persons’ ratings, is immune to same source bias, and second, I would have reduced reliability of the dependent variable by employing a one-item instead of a two item measure.
recipient in separation, but also the interplay of the two agents’ characteristics to explain knowledge transfer.

5.1.3. Influences at multiple levels

One of the core techniques applied in the present dissertation is multilevel analysis, enabling the simultaneous consideration of independent variables at different organizational levels. The results of the different papers emphasize that such an approach is important; they clearly showed that knowledge transfer was significantly influenced not only by dyadic or individual level variables, but also by team or context factors. For example, in all three papers, team level predictors like job autonomy (paper one), age diversity (paper two), and intragroup trust (paper three) had a significant effect on knowledge transfer. In paper two, it was even predictors at three rather than just two levels that have been shown to exert an influence. These results markedly strengthen the arguments presented in paper one: individual knowledge transfer occurs in a multifaceted context by which it is influenced in many ways, and, accordingly, this context has to be taken into account when knowledge transfer is investigated. In a similar vein, Foss, Husted, and Michailova (2010) put forth that for reliable explanations of organizational level knowledge transfer, micro, i.e., individual level, constructs have to be taken into account. Taken together, this is a strong call for multilevel analysis in any type of future knowledge transfer research – no matter if the unit of analysis is at the dyadic, the individual, or a higher level.

5.2. Limitations

Just as the single papers have certain limitations, so does the dissertation as a whole. Some of these limitations have already been mentioned in the respective chapters, others arise upon the inspection of the interplay of the three articles and with respect to the overall research
questions. The limitations that will be presented in the following will then be built upon to judge if the objectives of the dissertation have been reached (5.3.) and to evaluate the contributions to the research field (5.5.).

5.2.1. Study design

First, one of the overarching limitations of this dissertation concerns the study design: the two datasets that form the basis of the present work were both collected via questionnaires (the first one paper-pencil, the second one online) and with a cross-sectional design. Thus, the common limitations of survey studies apply here as well: although conclusions can be drawn concerning relationships between knowledge transfer and other variables, the direction of effects can only be hypothesized about. Furthermore, with the exception of paper two, where the dependent variable was an average across ratings from two different sources, the results might also be subject to single-source bias. Of course, precautions recommended by Podsakoff, MacKenzie, Lee, and Podsakoff (2003) were taken, for example the utmost protection of respondents’ anonymity, clarification of key concepts, and the use of different scale endpoints and formats for predictor and outcome measures. Still, the possibility of such biases cannot be completely dispelled.

5.2.2. Operationalization of knowledge transfer

Second, another limitation that applies to the entire dissertation concerns the operationalization of the key variable, that is, knowledge transfer and the respective knowledge transfer behaviors. The operationalization of these behaviors was realized via subjective ratings of frequency of knowledge transfer. As I will now discuss, capturing knowledge transfer is challenging irrespective of the study design, but it is even more so in survey studies compared to lab or certain field studies.
In lab studies, knowledge contents can be created and manipulated, and the transfer of knowledge can be measured, e.g., via observation. In field studies concerned with knowledge transfer via databases, emails, or other electronic pathways, the knowledge transfer activities are usually stored electronically and can then be analyzed. In both of these cases, you have a rather objective measure of knowledge transfer. In survey studies, on the other hand, such an objective measurement is not possible. Instead, researchers have to rely on subjective statements of participants. In the extant literature, the measurement approach in such survey studies has usually been to let participants either rate their agreement with statements such as “In my work team, I have learned new things from my colleagues that only they knew.” (Zárraga & Bonache, 2005, p.669; similar items in: Bock, Zmud, Kim, & Lee, 2005; Kankanhalli et al., 2005; Cabrera, Collins, & Salgado, 2006), or rate the frequency of knowledge transfer behaviors, e.g., “On average, how often did you share each type of knowledge during the project with group members?” (Cummings, 2004, p. 357; similar items in: Kankanhalli et al., 2005; Watson & Hewett, 2006). The latter approach was followed in the present work.

Unfortunately, survey studies are not only inferior to lab studies and the analysis of stored electronic data with respect to measurement objectivity, but also with respect to characteristics or types of knowledge transfer that can be measured (e.g., explicit vs. tacit). When, for example, knowledge transfer via electronic pathways is considered, researchers can perform a content analysis of the knowledge transferred and differentiate between different types or qualities of knowledge transfer. In survey studies, such categories have to be defined beforehand, and with each additional category, you multiply the number of items used for measurement. Furthermore, especially when you are dealing with participants with very different occupations, as in the present dissertation, it is hard to define such different types of knowledge and phrase items accordingly; examples of tacit knowledge for an IT administrator...
would be very different than for a finance clerk. In the first study, I tried to capture the
distinction between explicit and tacit knowledge by letting participants rate the frequency of
sharing / seeking of factual knowledge versus experiential knowledge. Unfortunately, the
correlation between these two items was too high \( r = 0.76 \) to reasonably allow for a
distinction between two different types of knowledge.

Only investigating the frequency of knowledge transfer without distinction of
qualitatively different types of knowledge naturally has implications for the type of
conclusions that can be drawn. In short, you know only half the story, as (predictors of) the
amount of knowledge transfer as well as (of) the quality of knowledge transfer are still
unknown. You do know what induces employees to transfer knowledge on more occasions,
but you do not know what leads them to transfer more or richer knowledge on such occasions.
And of course, when intergenerational knowledge transfer, the change in transfer when
organization exit is expected, or consequences for knowledge loss are of interest, it is not just
the frequency, but equally, if not more so, the amount and quality of knowledge transfer that
we want to know about. Thus, this is a major restriction of the dissertation and something that
has to be solved for future research.

5.2.3. Knowledge transfer behaviors selected

The third overarching limitation of the study concerns the selection of knowledge transfer
behaviors studied. In section 1.1.5. of chapter one, I described that the focus in this
dissertational work was on knowledge seeking and knowledge sharing, while acknowledging
that successful knowledge transfer comprises at least one more process or behavior, namely
knowledge absorption by the recipient. As Davenport and Prusak (1998) put it, “If knowledge
is not absorbed, it has not been transferred.” (p. 101). Thus, with the knowledge transfer
behaviors studied here, I actually did not look at complete knowledge transfers, but rather at
behaviors that happen in the first phases of knowledge transfer. Using Szulanski’s (1996) stage model of knowledge transfer, I only investigated initiation and parts of implementation. When knowledge transfer is initiated, it is either the recipient who is searching for a specific piece of knowledge (seeking knowledge) or it is the source who has a certain piece of knowledge and deems it important for a colleague. The implementation of knowledge transfer would then comprise the actual sharing, but furthermore the absorption which has not been covered here. Of course, not all knowledge transfers that are initiated (i.e., knowledge is sought, or shared, or both) will eventually become successful knowledge transfers in that knowledge is shared and absorbed. Thus, by looking at seeking and sharing knowledge only, we can, strictly speaking, only draw conclusions about predictors and outcomes of the initiation and part of the process of knowledge transfer, but not about complete, successful knowledge transfers. Although this limitation still allows for important theoretical conclusions, it certainly impairs practical implications, as the main interest of practitioners is, and should be, successful knowledge transfer.

5.2.4. More knowledge transfer is better

The fourth limitation concerns a general assumption that was implicitly made throughout the dissertational work: The assumption that more knowledge transfer is always better. Knowledge transfer has so far been presented as merely positive, as a strategy to prevent knowledge loss, as a means to spike productivity, and as a way to gain competitive advantage. But although knowledge transfer has been shown to have positive effects, for example on performance (Collins & Smith, 2006; Cummings, 2004; Darr, Argote, & Epple, 1995; Mesmer-Magnus & DeChurch, 2009; Quigley et al. 2007; van Wijk, Jansen, & Lyles, 2008), knowledge transfer benefits are very much situation-specific (Foss et al., 2010), that is, not in all work situations is knowledge transfer beneficial. According to Foss and colleagues (2010)
“there are situations where knowledge sharing is much less desirable; for example, because it is too costly, it increases the risk of knowledge spillovers to an unacceptable level, or because it reinforces group-think and hampers innovation.” Considering, for example, that knowledge sharing is very costly for the knowledge source in terms of time, effort, and energy (Constant et al., 1996; Goodman & Darr, 1998; Reagans & McEvily, 2003; Szulanski, 1996), knowledge transfer might hamper the source’s productivity more than it increases the recipient’s. Furthermore, just as the threat of knowledge loss is not equally strong for all jobs in all departments (see section 1.2.), knowledge transfer is not equally beneficial for all types of jobs. Accordingly, when investigating knowledge transfer, the basic necessity for knowledge transfer for the employee or team should be taken into account (i.e., controlled), either through objective considerations or subjective statements of participating employees or their supervisors. Depending on this necessity, it is possible that otherwise effective levers of knowledge transfer do not show significant effects, simply because knowledge transfer is not beneficial for this job (and not cherished by the management). Such a control variable has not been used in the present study, maybe with the exception of paper three, where perceived supervisor support for knowledge sharing was a significant predictor of frequency of knowledge sharing. It could be argued that supervisor support would not be given if knowledge sharing would not be considered beneficial. In the other two papers, however, such a variable is missing in the analysis.

5.3. **Attainment of Research Objectives**

A question that is inevitably asked at the end of a large research project such as a dissertation is if the research objectives that were set at the beginning of the project have been reached. As has been described in the introduction, the aim of the present dissertation was to examine
knowledge transfer between employees as a means to prevent knowledge loss. To this end, I wanted to investigate the following questions:

- How can knowledge transfer be encouraged and impaired?
- Beyond general knowledge transfer, what about intergenerational knowledge transfer?
- Can day-to-day knowledge transfer really be an adequate pathway to the prevention of knowledge loss?

In the following, I will evaluate, one by one, the answers obtained to the above questions before taking a broader perspective and discussing the attainment of the broader objective of this dissertation.

5.3.1. Encouraging and impairing knowledge transfer

In paper one, I gave a brief review of the literature on predictors of knowledge transfer, concluding with the statement that a clear understanding of the underlying pattern of influencing factors is still missing, and that some of the results found in the extant literature are actually contradictory or inconclusive. Therefore, I slightly modified the original research question from “what are the most important influencing factors?” to “why do we not know about them so far?”, and looked for measures that could be taken to lead to clearer results in the future. The resulting two distinctions have been amply discussed (see chapter two, and section 5.1.2.). And although I have contributed to the literature on predictor variables by adding new explanatory factors (age, autonomy at the individual level) and consolidating existing ones (intrinsic motivation, perceived supervisor support), the original research question remains unsatisfactorily answered. What is missing here and should be done in the future is a meta-analysis on predictors of individual level knowledge transfer (of course,
employing the distinctions recommended in paper one), similar to the one that has been conducted by van Wijk and colleagues (2008) for the business unit and organizational level.

5.3.2. Intergenerational knowledge transfer

What led me to investigate intergenerational knowledge transfer was rather a fuzzy interest than a clear research question. The issue of age effects at different levels arose from the results of the first study, but it would have been equally interesting to investigate if predictors of intergenerational knowledge transfer differ from those of “general” knowledge transfer, how knowledge transfer from older to younger employees differs from transfer in the opposite direction etc. As there is, so far, very few theoretical and basically no empirical literature on this topic, there of course remain many questions to be answered with respect to the construct of intergenerational knowledge transfer. One of the many possible questions that can be posed, I did answer, namely, “is more knowledge shared when the age difference between source and recipient is larger.” But I would like to answer many more in future research.

5.3.3. Day-to-day knowledge transfer as a pathway to prevention of knowledge loss

For this question to be answered, a sound measurement of knowledge loss would be necessary. Although first attempts have been made (Massingham, 2008), a lot of work still needs to be done to obtain such a measurement. Thus, I opted to indirectly address the threat of knowledge loss by looking at a situation in which such a threat would be present: when employees expect or intend to leave their organization. Thus, instead of looking at the influence of knowledge transfer on knowledge loss, I investigated the question of what happens to knowledge transfer with colleagues in situations that might bear the risk of knowledge being lost for the organization. Of course, by applying this twist, the original research question cannot be fully answered.
Furthermore, as I did not preliminarily evaluate if the employees who thought of leaving did actually have knowledge that would create costs if lost, it is questionable in how far results really say something about the appropriateness of knowledge transfer as a strategy to prevent actual knowledge loss. Thus, the results obtained and described in chapter 4 can only give a first clue about the adequacy of day-to-day within team knowledge transfer as a strategy to prevent knowledge loss, but the question as such stands to be answered.

5.3.4. Overall: Knowledge transfer and the prevention of knowledge loss

Summing up, the research question that inspired this dissertation has not been satisfactorily responded to, but several parts have been added to the puzzle that constitutes the answer. Nevertheless, adding to the points mentioned in the last three sections and under limitations, it should be noted critically that with the very broad definition of knowledge applied in this research and with measuring the quantity of knowledge seeking and sharing in work teams, it might not even be possible to properly capture the transfer of knowledge that is at risk of being lost. Instead, it might be necessary to use much narrower definitions of knowledge, that are content or job-specific, to really be able to address the research question at hand.

Thus, it remains for future research to complete the puzzle and shed more light on predictors of knowledge transfer behaviors as well as their outcome with respect to knowledge loss, as well as on the role intergenerational knowledge transfer might play. Some directions for such future research are presented in the following.

5.4. Future Directions

The previous section clearly shows that there are still many open questions with respect to the broader as well as the more specific issues investigated in this dissertation. For example, as already mentioned, a meta-analysis on individual level knowledge transfer would constitute a
valuable addition to the existing literature, and would help clarify the picture of predictors of knowledge transfer. Furthermore, intergenerational knowledge transfer seems to be a promising construct for further research with many open questions concerning its divergence from general knowledge transfer (e.g., with respect to predictors), and the opportunities of positive outcomes as well as challenges it might present. But with respect to practical relevance, and the main research question of this dissertation was born out of a very practical problem, the most interesting and most pressing question is, in my opinion, the one concerning the impact of knowledge transfer on knowledge loss, or, framed more broadly, the influence of different prevention strategies on actual knowledge loss.

As already mentioned in section 5.3.3., one of the major challenges for investigations to this end is the measurement of knowledge loss. Directly measuring knowledge loss is rather complicated, as this builds on measuring a change in the knowledge base, for example, of a team. And measuring changes in the knowledge of a unit is very challenging, as it entails various problems, e.g., because parts of knowledge are tacit and cannot be captured in verbal assessments (Argote & Ingram, 2000). Thus, a direct measurement of knowledge loss would possibly necessitate an entirely new and creative approach, potentially combining different measurement techniques. Instead, researchers might rather try to capture knowledge loss indirectly via its effects on team processes, productivity, innovation, creativity, etc. To do so, researchers could, for example, build on work on turnover: there is quite a large body of literature on consequence of turnover, for example, the turnover of indispensable employees (Starke, Dyck, & Mauws, 2003). A recent attempt at measuring the effects of knowledge loss has been presented by Massingham (2008), who tried to capture effects on human capital, social capital, structural capital, and relational capital. For a direct, but even more so for an indirect measurement of knowledge loss, it would furthermore be necessary to investigate a
sample of employees who have valuable knowledge that only they (or only a few others) possess, knowledge that would represent a significant loss in case they leave.

Moreover, in such a study, it would be advisable to adjust the operationalization of knowledge transfer to a) cover successful knowledge transfer (e.g., by adding knowledge absorption as a behavior), and to b) differentiate between different types or qualities of knowledge transfer.

In terms of study design, longitudinal measurement approaches are absolutely necessary, and this for knowledge transfer research in general, but for research on knowledge loss in particular. Ideally, the time lag between measurement points should be rather large (e.g., six months or a year) in order to get a large enough sample of employees who did actually leave, and who possibly created knowledge loss that can be estimated. In addition, instead of singularly looking at effects of knowledge transfer, other knowledge retention strategies, e.g., debriefings, could be examined with respect to their knowledge loss prevention capabilities. Moreover, different strategies could be compared. Such research would yield important practical implications, and could help organizations prepare for some of the challenges that the demographic change entails.

As is evident from these illustrations, research on knowledge loss is far from simple, and involves many challenges in terms of operationalization, study design, and sample selection. Thus, I am looking forward to seeing this field of research grow, and am hoping to be able to further contribute to it in the future.

5.5. Contributions to the Field of Knowledge Management

The limitations presented in section 5.2. as well as the considerations put forth in section 1.2. and 1.3. of chapter one suggest that the research done for this dissertation on the one hand
covers a very specific area of knowledge management research, namely the frequency of individual level knowledge sharing and seeking within work teams. On the other hand, it is still very broad in that it does not differentiate between possibly important constructs, e.g., explicit versus tacit knowledge or level of necessity of knowledge transfer for the respective employee. Furthermore, it is limited in the power of conclusions that can be drawn, due to relying on cross-sectional survey data.

Thus, the question of the relevance of the present findings and their contribution to the field has to be considered. In the following, I will describe what I regard, despite the above mentioned restrictions, as my contributions to the field of knowledge management more generally and to the field of knowledge transfer more specifically.

With respect to the field of knowledge management, I think my major contribution has been to take a first step toward the empirical investigation of strategies for the prevention of knowledge loss. With the imminent demographic change, the topic of knowledge loss will be increasingly important in the knowledge management literature (Leibold & Voelpel, 2006). And although several theoretical models and considerations of the topic can be found, there have so far only been very few attempts at approaching the issue empirically (Massingham, 2008; although there have been several studies with a broader focus on the consequences of downsizing and turnover). With my research, especially the third article, I have taken a very first step in this direction, showing that day-to-day knowledge sharing might constitute a feasible prevention strategy as employees intending to leave share more knowledge, and those that are expecting to leave involuntarily can be encouraged to share by their supervisors. Furthermore, paper two showed that in teams, more knowledge transfer exists from older to younger employees, suggesting that there is a natural increase in intergenerational knowledge transfer, which could be used to establish knowledge transfer between retiring older employees and younger colleagues. Of course, these are only very first steps focusing on a
single strategy and not even measuring knowledge loss, but they might raise attention to and interest in this important topic.

Some other findings from the different papers presented might not have implications for the entire field of knowledge management, but bear certain relevance for the field of knowledge transfer research:

First, the results of this dissertation strengthen the importance of a differentiated consideration of different agents and behaviors involved in knowledge transfer. While Szulanski (1996) focused on the transfer of knowledge between business units and emphasized that both, the source and the receiving unit play an important role, I brought forth the same point with respect to the individual level. Thereby, I strengthened the argument of a separate treatment of both agents and contributed to the establishment of a distinction that might be helpful to disentangle so far inconclusive results in the literature, which oftentimes only looks at knowledge sharing or at knowledge transfer as a broader construct (see chapter 2).

Second, in a similar vein, my results add to the call for more multilevel research oriented at taking context effects into account and including lower levels of analysis. As described in chapter 2 as well as in section 5.1.3., several authors have already drawn attention to this point, either hinting at the importance of contextual factors (Kostova, 1999; Szulanski, 1996) or the analysis of explanatory variables at different levels (Foss et al., 2010). Results of the present dissertation clearly show that it is important to take contextual effects and predictors at different (higher) levels into account, as they explain a considerable amount of variance and can very much differ from effects at lower levels (see the example of autonomy in study one). This should not only bear importance for research undertaken at the dyadic or individual level of analysis, but for higher levels as well. Furthermore, results of the present work strengthen
the importance of including lower levels of analysis; as results of paper two revealed, knowledge transfer seems to be more a matter of dyads than of individuals or teams.

The third contribution to the field of knowledge transfer concerns the role of age. With this dissertation, I took a first step toward the analysis of age effects on knowledge transfer as well as the basis of such age effects. Even though the relationships found might have been weak, I consider this a promising alley, as the changing age structure of the work force will make the investigation of accompanying effects on several constructs and organizational processes, including knowledge transfer, necessary. Introducing the topic of intergenerational knowledge transfer as well as presenting effects of age difference at the dyadic level and age diversity at the team level not only raises awareness for age-related changes, but might also build the starting point for much more research on this topic (see section 5.4.).

5.6. **Concluding Remarks**

The theoretical and empirical work presented in the framework of this dissertation has demonstrated that knowledge transfer is an important but complex construct to study, with a multitude of influencing factors at different levels. This turns the management of knowledge transfer processes literally into a science. But besides all the explained variance, significant influences, moderations, and mediated effects, we should not forget that knowledge is transferred whether the process is managed or not, and that engaging in knowledge transfer can be very easy. I would like to come back here to the quote taken from Davenport and Prusak (1998), “How can an organization transfer knowledge effectively? The short answer, and the best one, is: hire smart people and let them talk to one another.”

Knowledge transfer happens all the time, and on closer inspection, it just happened – while you were reading these pages.
5.7. References


