Collaboration in open-plan offices

Gemma Louise Irving

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Abstract

Many organisations have adopted open-plan offices, rooms with few barriers between desks that are shared by more than four people, to facilitate collaboration, productivity, and innovation. Yet researchers have found that open-plan offices do not consistently promote positive outcomes, and are often associated with unintended consequences like conflict, distractions, and reduced productivity. A major area of disagreement in the literature relates to whether open-plan offices facilitate collaborative behaviours (i.e. cooperation, coordination, information sharing). Although some researchers argue that open-plan offices facilitate interaction by bringing people into physical proximity, others suggest that open-plan offices lack the architectural privacy to allow employees to talk openly, without being overheard by others. There is not clear empirical support for either perspective.

In this dissertation, I resolve mixed findings about the link between open-plan offices and collaboration by drawing on situated cognition theory. I show that a combination of individual schemas (i.e. mental models), physical contexts (i.e. open-plan offices), and social contexts (e.g. team relationships) combine to shape how individuals and teams use open-plan offices to collaborate. Rather than focusing on whether or not open-plan offices facilitate collaboration, I describe the open-plan office as a collaborative scaffold that facilitates particular kinds of collaborative behaviours (e.g. instant information sharing, vicarious learning) under particular circumstances (e.g. where team members have collaborative norms and high levels of task-interdependence). I explore the relationship between open-plan offices and collaborative behaviour through three qualitative studies.

In Study 1, I examined how new collaborative relationships form in open-plan offices through a single case-study of a collaborative science building. I conducted 245 hours of observation and interviews with 40 employees. The findings of Study 1 challenge existing research that suggests that chance encounters are the link between open-plan offices and collaboration. Instead I found that new collaborative relationships are formed through serendipitous encounters that involve an element of both intention and chance.

In Study 2, I explored the situations in which open-plan offices facilitate and inhibit collaboration, through a comparative case-study of eight groups of employees in open-plan offices. I used the same data for Study 1 and 2. In Study 2, I resolved mixed findings in the existing literature about open-plan offices and collaboration. I found the interplay between individual schemas (role, rule, person) and contexts (physical, social, and embodied) shaped whether or not groups used the open-plan office to collaborate. Specifically, open-plan offices facilitate collaboration when the majority of people in an office want to collaborate and adjust their behaviour to respect their colleagues’ noise preferences.
In Study 3, I examined how teams use open-plan office to collaborate through a comparative case-study of seven teams in open-plan offices. I conducted 251 hours of observations and interviews with 33 team members from three organisations. The findings of Study 3 show that open-plan offices are a collaborative scaffold that facilitates four kinds of collaborative behaviours: instant information sharing, informal cooperation, contextualised cooperation, and vicarious learning. I also found that teams with collaborative norms and high-levels of task-interdependence overcame the negative aspects of open-plan offices, such as distractions and lack of privacy, because they had relationships that allowed them to openly discuss office noise.

Overall, in this dissertation, I make four key contributions. First, I contribute to research on the relationship between open-plan offices and collaboration, by exploring collaboration as a process, rather than an outcome. In contrast to existing literature, where researchers have focused on whether or not open-plan offices facilitate collaboration, I outline the circumstances under which open-plan offices are likely to have positive, negative, and neutral impacts on collaboration. Second, unlike existing studies that have examined patterns of interactions between established colleagues in open-plan offices, I describe how new collaborative relationships form in open-plan offices. In contrast to the existing literature, where researchers have argued that chance encounters are the link between open-plan offices and collaboration, I find that new collaborative relationships form as a result of serendipitous encounters that involve both intention and chance. Third, I explain mixed empirical findings about the link between open-plan offices and collaboration by showing that employees use open-plan offices to collaborate when the majority of people in an open-plan office want to work together and when formal task-interdependencies create incentives for collaboration. Fourth, this dissertation is one of the first empirical studies of teams in open-plan offices. Unlike existing research, which has focused on individual responses to open-plan offices, I found that team members are able to overcome the negative impacts of open-plan offices such as distractions and interruption. Overall in this dissertation, I show that open-plan offices do not always facilitate collaboration. Thus, to foster collaboration in open-plan offices, managers should explain the benefits of collaboration, model collaborative behaviours, design interdependencies within and between work units, and reward employees who collaborate.
**Declaration by author**

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications during candidature

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<tr>
<td>Gemma Irving</td>
<td>Collected the data (100%)</td>
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<td>Analysed the data (70%)</td>
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<tr>
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<td>Wrote the paper (70%)</td>
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<tr>
<td>Oluremi Ayoko</td>
<td>Provided feedback on analysis (20%)</td>
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<td>Wrote and edited paper (20%)</td>
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<tr>
<td>Neal Ashkanasy</td>
<td>Provided feedback on analysis (10%)</td>
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Chapter 6 has been accepted at the 2016 Academy of Management Conference, as the following paper:

Contributions by others to the thesis

This thesis was revised based on advice and comments from my advisors Associate Professor Oluremi Ayoko, Professor Neal Ashkanasy, and Professor Karen Jehn. My readers, Associate Professor Bernard McKenna, Dr Patricia Rowe and Dr Stephen Jones, also provided feedback that I incorporated into the document. The final version of this thesis was copy edited by a professional editor.

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LIST OF ABBREVIATIONS USED IN THE THESIS

Nil
CHAPTER 1: INTRODUCTION

1.1 Introduction

In both organisational theory and in practice, open-plan offices are associated with controversy, paradoxes and unintended consequences (Ashkanasy, Ayoko, & Jehn, 2014; Elsbach & Bechky, 2007; Elsbach & Pratt, 2007). Open-plan offices are rooms shared by upwards of four people (often more than 24 people) where workstations are freely arranged in groups and where there are few physical barriers between workstations (Bodin-Danielsson & Bodin, 2008). While advocates of open-plan offices have argued that open-plan offices enhance collaboration, innovation and performance (Allen & Gerstberger, 1973; Boutellier, Ullman, Schreiber, & Naef, 2008), opponents of open layouts have suggested they impair concentration, inhibit productivity and can actually undermine, rather than facilitate, collaboration (Hatch, 1987; Kim & de Dear, 2013; Värlander, 2012). De Croon et al. (2005) found that one of the most contested topics relates to whether or not open-plan offices facilitate collaboration, where collaboration is defined as group behaviour that involves cooperation (i.e. working together on a shared task), coordination (i.e. synchronising activities) and information sharing (Rousseau, Aube, & Savoie, 2006). In light of this debate, I focus on the relationship between open-plan offices and collaboration.

In terms of empirical research, there has been little research that explicitly examines the relationship between open-plan offices and collaboration, particularly in the context of teams (for exceptions see Hua, Loftness, Heerwagen, & Powell, 2010; McElroy & Morrow, 2010). As Ashkanasy et al. (2014) argued, most of the research on open-plan offices is focused on individual outcomes, such as performance, satisfaction, and wellbeing, rather than on group or team processes, such as collaboration. Furthermore, in their review of existing research De Croon et al. (2005) demonstrated that, where researchers have studied collaboration—or related behaviours such as interaction, communication and coordination—they have not found a clear relationship between particular features of the physical work environment (i.e. barriers, layouts) and particular behaviours.

In this dissertation, I contend that one of the reasons for these mixed findings is that open-plan office researchers have conceptualised collaboration as an outcome, rather than a process. As a result, scholars have been mainly concerned with how much (e.g. Boutellier et al., 2008; Hatch, 1987), or how satisfied (e.g. Kim & de Dear, 2013; Sundstrom, Herbert, & Brown, 1982) employees are with their interactions in the open-plan office. The problem with focusing on collaboration as an outcome is that it ignores both the content and the context of communication. Employees in open-plan offices may communicate more frequently, but as Ayoko and Härtel (2003)
argued, this could be in the form of conflict about limited space and resources. Thus, scholars first need to understand the kinds of interactions (collaborative or otherwise) that are facilitated in open-plan offices before they can anticipate the impact of open layouts on team outcomes.

Given these issues, I aim to unravel the mixed empirical findings to show why open-plan offices are so commonly associated with different outcomes in regard to collaboration. Thus, in this dissertation I focus on the processes by which open-plan offices lead to different outcomes, rather than on the outcomes themselves. Additionally, the purpose of this dissertation is not to evaluate the effectiveness of open-plan offices on individual outcomes such as productivity, satisfaction or wellbeing, since there are many studies that examine these issues (e.g. Bodin-Danielsson & Bodin, 2008; Brennan, Chugh, & Kline, 2002; Lee & Brand, 2010). Furthermore, I do not examine the impact of open-plan offices on team effectiveness, efficacy or other outcomes; although there is scope for research in this area (see Ashkanasy et al., 2014). A central contention of this dissertation is that scholars first need to understand how individuals and teams use open-plan offices, before they can anticipate the conditions under which open-plan offices may support positive (and negative) outcomes for teams.

Through the three empirical studies outlined in this dissertation, I argue that collaboration must be understood in the context of individual, social and physical conditions. For example, factors such as whether or not employees want to collaborate, the nature of existing relationships between employees, and formal structures such as roles and interdependencies, are all likely to impact on how employees use open-plan offices. Yet there is no theoretical approach within organisational behaviour that simultaneously accounts for the individual, social and physical factors that shape collaboration in open-plan offices. Thus, a second aim of this dissertation is to provide a contextual account of how collaboration unfolds in open-plan offices. To meet this aim, I re-evaluated existing approaches to the relationship between physical work environments and behaviour, by drawing on situated cognition theory (Elsbach, Barr, & Hargadon, 2005; Semin & Smith, 2013). Consistent with Elsbach, Barr and Hargadon’s (2005) conceptualisation of situated cognition theory, I argue that collaborative behaviour is situated in particular individual cognitions and socio-physical contexts. Thus, to understand whether or not employees collaborate in open-plan offices, scholars need to account for individual factors (e.g. employees’ motivations to collaborate), social context (e.g. collaborative norms), and physical context (e.g. whether or not features such as barriers, furniture, and noise in the physical environment make it possible and/or comfortable to engage in collaboration).

Unlike existing research, where scholars have implied that open-plan offices cause collaboration (Fayard & Weeks, 2007), I found that the open-plan office is better conceptualised as a scaffold for collaboration. The scaffold metaphor (Clark, 1997) captures the idea that open-plan
office environments enable, support, and make possible particular ways of collaborating such as instant knowledge-sharing and vicarious learning. Yet a scaffold cannot cause people to collaborate, so it is unlikely that co-locating employees who do not want to work together in an open-plan office will result in collaboration. However, in the case of co-located employees who do want to collaborate, an open-plan office can enable them to engage in particular forms of collaborative behaviour (i.e. instant information-sharing, informal coordination, contextualised cooperation and vicarious learning).

The overall contribution of the dissertation is therefore to challenge existing research on the relationship between open-plan offices and collaboration. Consistent with this aim, I argue that the open-plan office is a scaffold for collaboration (see also Clark, 1998). To meet the aim I structured the dissertation around seven chapters, listed here in sequential order: Introduction, Literature Review, Methodology, Study 1, Study 2, Study 3, and Discussion. Although the rest of the dissertation follows a traditional monograph structure, I present Studies 1, 2, and 3 as discrete papers, each with its own literature review, methodology, results and discussion section. The paper format allows me to present a large amount of qualitative data succinctly, and to demonstrate how each study addresses a distinctive limitation of the existing literature. Thus, Studies 1, 2, and 3 each make a contribution on their own terms, as well as to the dissertation as a whole. At the time of writing, the three studies are not under review at a journal and are not published.

Although there is some necessary overlap between the earlier and later chapters, I minimise this where possible. In Chapter 2’s literature review I provide a historical account of the research on open-plan offices, and describe the theoretical framework for the whole dissertation. In the focussed literature reviews in Studies 1, 2 and 3, I present specific literature relevant to the problem addressed by that study. In the discussion of methodology in Chapter 3, I outline the critical realist paradigm and justify the case-study method. In contrast, in the methods sections of Studies 1, 2 and 3, I cover specific issues related to each sampling and data collection exercise. Finally, in Chapter 7’s discussion, I integrate the three studies and address the contributions of the dissertation as a whole. In the discussion sections in Studies 1, 2 and 3, I cover the specific contributions, limitations and implications of each study.

In this dissertation, I collect and analyse two data sets that I present as three studies. Study 1 and 2 include data collected from a collaborative science building, which is occupied by three government organisations. Study 3 includes data that was collected from seven teams in three organisations (a university, a resources company and an insurance company). The three empirical studies in this dissertation each make a distinct contribution to the literature on physical work environments, open-plan offices and collaboration. In Study 1, I contribute by examining how individuals form new collaborative relationships in open-plan offices. This challenges the
assumption that open-plan offices promote collaboration by facilitating chance encounters (e.g. Boutellier et al., 2008; Davis, Leach, & Clegg, 2011; Monge, Rothman, Eisenberg, Miller, & Kirste, 1985), and shows that encounters in open-plan offices involve both chance and intention. In Study 2, I contribute by addressing the mixed empirical findings on the relationship between open-plan offices and collaboration (De Croon et al., 2005). This demonstrates that open-plan offices are likely to promote collaboration when the majority of people in the open-plan office want to collaborate. Finally, in Study 3 I answer Ashkanasy, Ayoko and Jehn’s (2014) call for the exploration of team issues in open-plan offices. The results of Study 3 show that open-plan offices shape the process of collaboration in teams by facilitating instant information-sharing, informal coordination, contextualised cooperation and vicarious learning. Taken as a whole, the three studies offer a new way of understanding the relationship between physical work environments and behaviour, by providing empirical support for an understanding of the open-plan office as a collaborative scaffold.

In the rest of Chapter 1, I elaborate on the conceptualisation of the open-plan office as a collaborative scaffold. I define the key concepts in this dissertation, including the physical work environment, collaboration and situated cognition theory. Next, I outline the four limitations of existing literature on collaboration in open-plan offices and explain the contributions of this dissertation. This is followed by a description of situated cognition theory (Elsbach et al., 2005), which I use to describe collaborative behaviour as emerging from an individual in their social and physical context. In the following section, I present four research questions that relate to the development of new collaborative relationships in open-plan offices, the conditions under which open-plan offices support collaboration, and how teams use open-plan offices to collaborate. I describe how I answer these questions through Studies 1, 2, and 3. Study 1 is a single case study of a collaborative building; Study 2 is a comparative case study of employees in eight open-plan offices; and Study 3 is a comparative case study of seven teams in open-plan offices. Finally, I outline the structure of the dissertation and explain how the investigation of collaboration in open-plan offices unfolds.

1.2 Definitions

In this section I define key concepts that relate to physical work environments, open-plan offices, collaboration, and situated cognition theory. A summary of terms is also provided in the Glossary in Appendix 1. Elsbach and Pratt (2007) define the physical work environment as consisting of all the physical objects that employees encounter in organisations (e.g. tools, technologies, equipment, ambient conditions) as well as the arrangements of those objects (e.g. factory layouts, team spaces, open-plan offices). In this dissertation, I describe open-plan offices as
one kind of physical work environment. According to Bodin-Danielsson and Bodin (2008), open-plan offices are shared rooms where desks are freely arranged in groups. Small open-plan offices are occupied by 4 to 9 employees, medium open-plan offices have space for 10 to 24 employees, and large open-plan offices have space for more than 25 people. Open-plan offices may incorporate barriers between desks that vary from waist to neck height or higher, but do not extend all the way from the floor to the ceiling. Furthermore, employees in open-plan offices share amenities, such as printers, photocopiers and kitchen spaces.

Alongside small, medium, and large open-plan offices, Bodin-Danielsson and Bodin (2008) also identify four types of offices that vary in terms of form and function. These offices are the cell office, the shared-room office, the flex office and the combi office. A cell office is a room with four walls and a door that is occupied by one person, while a shared-room office is a cell office shared by 2 or 3 people. Flex offices and combi offices are similar to large open-plan offices in form, but vary in terms of function. In flex offices (also known as non-territorial or hot-desk offices), employees do not have allocated desks, but must choose a new desk each time they come into the office (see also Bean & Eric, 2006; Elsbach, 2003; Hirst, 2011; Warren, 2006). In combi offices (also known as activity-based offices), the space is not organised around individuals, but around tasks, with different spaces provided for individual work, client meetings, team work and other activities (Bodin-Danielsson & Bodin, 2008).

In this dissertation, I examine a broad range of open-plan offices, including those that vary in size, and those that incorporate allocated desks and hot-desks, to capture a wide range of open-plan layouts and their impact on collaboration. I investigate a broad range of open-plan offices because of Bodin-Danielsson and Bodin’s (2008) argument that open-plan offices vary in terms of form and function. Based on Bodin-Danielsson and Bodin’s (2008) typology, I sample individuals and groups occupying small, medium, large and flex offices in order to account for the impact of the physical and functional differences of open-offices on collaboration. Thus, I am confident that my findings are applicable to collaboration in all open-plan offices (rather than just medium open-plan offices, for example).

Collaboration is a term that has a number of different meanings in the organisational behaviour and management literature. Researchers have sometimes used the term collaboration to mean an inter-organisational relationship where participants do not rely on market or hierarchical control to gain cooperation (e.g. Hardy, Lawrence, & Grant, 2005; Majchrzak, Jarvenpaa, & Bagherzadeh, 2014), or to refer to the integration of knowledge to achieve a shared goal (e.g. Sheldon, Thomas-Hunt, & Proell, 2006; Skilton & Dooley, 2010). Given that the focus of this dissertation is on teams, I adopted Rousseau et al.’s (2006) definition of collaboration as a team behaviour that involves cooperation, coordination and information sharing. Briefly, cooperation
involves working together on a shared task (Rousseau et al., 2006); coordination involves integrating interdependent tasks (Okhuysen & Bechky, 2009); and information sharing involves the flow of messages between team members (Ipe, 2003).

In this dissertation, I drew on situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013) to argue that the open-plan office should be understood as a “collaborative scaffold”. Situated cognition is defined as the relationship between cognitive schemas (e.g. rule schemas, role schemas, person schemas) and organisational context (e.g. physical contexts, institutional contexts) (Elsbach et al., 2005). Schemas are simplified mental representations or models that contain knowledge about ourselves, other people, objects, and events, which allow us to make sense of the world in conditions of limited information (Walsh, 1995), while context is the opportunities and constraints that shape the occurrence and meaning of behaviour (Johns, 2006). In this dissertation, I contend that schemas (e.g. an individual’s understanding about whether or not it is appropriate to interact with others in an open-plan office) combine with the context of the open-plan office (e.g. the size of the office and the combination of other people in the office) to shape employee behaviour (e.g. whether or not employees collaborate). Furthermore, based on situated cognition theory, I argue that the open-plan office is a scaffold (Clark, 1997) that does not cause employees to collaborate, but which facilitates particular forms of collaboration (e.g. informal coordination, contextualised cooperation).

1.3 Research issues

Having introduced the key concepts of the dissertation, in this section I outline the research issues, including the limitations of the existing literature, the reasons why these limitations should be addressed, and the contributions of this dissertation. While this dissertation is located in the broader literature on physical work environments, the focus is on open-plan offices, which are at the centre of current popular and theoretical debates about the physical work environment (e.g. Ashkanasy et al., 2014; Davis et al., 2011; Kim & de Dear, 2013). Organisations have often adopted open-plan offices to support collaboration, but managers rarely understand the consequences of open-plan offices for employees and work teams (Vischer, 1999). Problems have often arisen because architects lack a clear understanding of the nature of the work carried out by employees; instead they have tended to rely on their own experiences or intuitive understandings about the kind of office spaces that are likely to support collaboration (Heerwagen, Kampschroer, Powell, & Loftness, 2004). Furthermore, organisations have often enthusiastically embraced open-plan layouts in the hope that they may foster free and frequent communication between employees, but have failed to assess the negative consequences of these offices on distraction, interruption, and privacy.
(Kim & de Dear, 2013). With these practical issues in mind, I identify four limitations of the existing research on open-plan offices and explain how this dissertation contributes to the literature.

The first limitation of the existing literature is that researchers have tended to study collaboration as an outcome, rather than as a process. To my knowledge, there are only two articles that explicitly examine collaboration in open-plan offices. Hua, Loftless, Heerwagen and Powell (2010) identify physical features (e.g. distance from desks to meeting rooms, percentage of floor space dedicated to shared areas) that employees perceive as conducive to collaboration, and McElroy and Morrow (2010) find that employees who move to a new, denser open-plan office perceive the corporate culture as more collaborative. Yet, this research is limited because it focuses on employees’ perceptions of collaboration rather than the collaborative behaviours themselves.

Alongside the two articles on collaboration in office environments, a number of researchers (e.g. Hatch, 1987; Kaarlela-Tuomaala, Helenius, Keskinen, & Hongisto, 2009; Oldham & Brass, 1979) have examined behaviours related to collaboration, such as communication, information sharing and coordination. Yet, researchers who study physical work environments have given little consideration to the reasons why employees interact (e.g. Boutellier et al., 2008; Fayard & Weeks, 2007). Instead, the focus has been on comparing the volume of communication, or employee’s satisfaction with communication, that occurs in different office environments (e.g. Kaarlela-Tuomaala et al., 2009; Millward, Haslam, & Postmes, 2007; O’Neill, 1994; Spreckelmeyer, 1993). For example, Boutellier et al. (2008) find that employees in open-plan layouts communicate more frequently and with more people, but for less time overall than employees in cell offices. Furthermore, Sundstrom, Herbert and Brown (1982) concluded that employees find communication neither easier nor harder after a move to an office environment with fewer barriers. Thus, collaborative behaviours have been typically conceptualised as outcomes and measured by researchers counting interactions, or by participants recording their perceptions in surveys and diaries (e.g. Hatch, 1987; Kim & de Dear, 2013). In contrast to existing research on communication in open-plan offices, I examine collaboration as a process, rather than as an outcome.

I choose to explore collaboration as a process, rather than as an outcome, to address the contribution of collaboration to group tasks. As Ayoko and Härtel (2003) show, open-plan offices can trigger communication in the form of conflict over limited space and resources. Thus, while researchers have previously explored how much time individuals spend communicating in open-plan offices, we still do not understand whether communication in open-plan offices helps or hinders group processes.

Throughout this dissertation, I contribute to the literature on open-plan offices by arguing that the open-plan office is a collaborative scaffold that can shape the process of collaboration. By focusing on collaborative processes, I explain how open-plan offices sometimes promote positive
outcomes, and sometimes negative outcomes. Rather than exploring whether open-plan offices lead to more or less collaboration (e.g. Boutellier et al., 2008; Hatch, 1987), I find that open-plan offices scaffold collaboration by facilitating instant information-sharing, informal coordination, contextualised cooperation and vicarious learning. This shifts the focus away from the relationship between physical features (e.g. barriers, layout) and behaviour, to the ways in which employees respond to opportunities and constraints in their open-plan office to complete day-to-day work activities.

The second limitation of the existing literature that I address in this dissertation is the lack of research on the development of collaborative relationships. I am unaware of any research in organisational behaviour that has explicitly looked at how new collaborative relationships form in open-plan offices. In the past, researchers have focused on comparing communication between workgroups in cell and open-plan offices (e.g. Hatch, 1987) or have followed a workgroup as they move from one office space to another (e.g. Brennan et al., 2002; Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979). The limitation of this research is that the people in these open-plan offices have already established relationships and thus are likely to feel a social obligation to interact when they encounter one another in the office (Fayard & Weeks, 2007). Thus, scholars yet know little about how unacquainted people may interact when co-located in an open-plan office.

There are three main reasons why it is important to explore how unacquainted people interact in open-plan offices. First, many organisations have adopted open-plan offices to break down boundaries between departments (e.g. Thurm, 2005). Thus, organisations use open-plan offices to foster new collaborative relationships between employees who are previously unacquainted. Second, co-working spaces are a new form of physical work environment that are supposed to promote the development of new collaborative relationships between freelancers (Gandini, 2015). Thus, co-working spaces are shared by employees who may be unacquainted until they begin using the office. Third, Hirst (2011) finds that employees only interact in open-plan offices when they sit next to a regular group of people with whom they have formed personal relationships. Thus, unacquainted people in open-plan offices interact differently to those who are acquainted. Overall, scholars need to better understand how open-plan offices shape collaboration among people who do not already know one another.

In Study 1, I address this limitation by exploring how open-plan offices shape the development of new collaborative relationships. I conduct this research in the context of a collaborative science building that brought together scientists from three government organisations. Managers hoped the building would promote the development of new collaborative relationships between scientists from different organisations. Consistent with research on proximity and interaction (Allen & Gerstberger, 1973; Davis et al., 2011; McCoy, 2005; Monge et al., 1985),
managers engaged an architect to design a building to foster chance encounters. In contrast to the existing literature, I find that people who are co-located in a shared open-plan office do not necessarily chance encounters, especially when they do not have an existing relationship. Specifically, in Study 1 I demonstrate that personal encounters in open-plan offices almost always involve elements of both intention and chance. When employees have formal job roles and interdependencies that require collaboration, they tend to notice and seize opportunities to collaborate in their physical work environment. For example, employees attend events, look for common interests with the people they meet, and introduce mutual colleagues when they encounter one another in the office. Conversely, employees who have no reason to collaborate tend to avoid shared areas and minimise their interactions with others; they thus experience few opportunities to meet new collaborators. Thus, by examining how open-plan offices facilitate the development of new collaborative relationships, I challenge the assumption that physical work environments shape interaction only through chance encounters. Instead I show that individual intentions shape whether or not employees use physical work environments to collaborate.

In addition to the focus on chance encounters, a third limitation of the existing literature is the mixed empirical findings. De Croon et al. (2005) have found inconsistent evidence on whether or not dense office layouts with few physical barriers promote communication. Furthermore, Elsbach and Pratt (2007) argue that there is no direct relationship between any features of the physical work environment (i.e. barriers, personalisation, nature-like surroundings) and collaborative behaviours such as cooperation, information sharing, and coordination. Although some researchers have found that open-plan offices are associated with improved collaboration (Allen & Gerstberger, 1973; Boutellier et al., 2008; Brennan et al., 2002), others have found that open-plan offices undermine face-to-face interaction and cooperation (Hatch, 1987; Kaarlela-Tuomaala et al., 2009). Furthermore, with regards to collaboration, Pepper (2008) has found that employees in open-plan offices often avoid using shared areas that are designated for collaboration, and Brennan et al. (2002) demonstrate that moving from private cell offices to small open-plan offices is associated with a decline in perceptions of collegiality among team members. To address the mixed empirical findings on the link between open-plan offices and behaviours, I examine the conditions under which open-plan offices facilitate and inhibit collaboration.

It is important to understand when open-plan offices facilitate collaboration and when they hinder collaboration, to guide managers and architects about the circumstances when they should adopt open-plan offices. As Heerwagen et al (2004) argue, the people involved in making decisions about the design and construction of physical work environments often assume that open-plan offices promote collaboration, without thinking through the specific kinds of collaboration that are made possible by open-plan offices and the specific kinds of employees that may benefit from
working in open-plan layouts. Bruns (2013:62) for example, shows that collaboration among cancer researchers often involves “working alone, together” which means that team members spend a lot of time completing individual tasks and then come together at specific points to coordinate future individual activities that contribute to the group effort. Conversely, Stigliani and Ravasi (2012) describe how product designers collaborate through intensive and ongoing conversations that involve being in the same room and collectively manipulating post-it notes and pictures on a wall, in order to come up with a new product design. Employees, who engage in the former kind of collaboration, are likely to suffer from distractions and lack of privacy in open-plan offices, while getting minimal benefit from the potential for improved collaboration (Kim & de Dear, 2013). Yet, so far the research on open-plan office has failed to account for who may benefit from collaborating in open-plan offices, and what kind of collaborative behaviours that open-plan offices may facilitate.

In Study 2, which uses the same data set as Study 1, I explore why open-plan offices facilitate collaboration for some groups and not others, by comparing groups of employees who work in eight open-plan offices in a collaborative science building (four offices where the groups are collaborative, and four offices where the groups are not collaborative). I contribute to the literature by showing that open-plan offices facilitate collaboration when the majority of employees in the open-plan office want to collaborate, a condition that is usually met when employees work as part of a team and have interdependent tasks and relationships. My findings demonstrate that employees want to collaborate when it is consistent with their individual characteristics, their formal work role, and their understanding about appropriate behaviour in the open-plan office. Furthermore, employees are more likely to collaborate when they share an office with other people who want to collaborate, and when they know the other people in the office. Thus, in Study 2 I resolve mixed findings in the existing literature by identifying the conditions in which open-plan offices promote and inhibit collaboration.

To explain the mixed findings further, I examine team processes, and the social context within which collaboration unfolds. Thus, in Study 3 I address a fourth limitation of the literature on collaboration in open-plan offices, which is the focus on individual issues at the expense of group and team issues (Ashkanasy et al., 2014). Most of the attention in the past few decades has been on open-plan offices and individual cognition (e.g. Bridger & Brasher, 2011; Roper & Juneja, 2008; Sundstrom, Town, Brown, Forman, & McGee, 1982). For example, Roper and Juneja (2008) argue that open-plan offices may heighten individual arousal and improve task performance via the social facilitation effect, but may also promote cognitive overload through crowding, office noise, distractions, and interruptions. Although some researchers have examined the social processes that create meaningful organisational spaces (e.g. Dale, 2005; Zhang & Spicer, 2013), they have not
explicitly examined team issues. Furthermore, researchers have focused on either individual outcomes or social processes without considering the links between the individual and the group.

Given these issues, Elsbach and Pratt (2007) argue that physical work environments promote both desired and undesired outcomes, and the positive impact of open-plan offices must be traded off against their negative aspects (see also Elsbach & Bechky, 2007). For example, Fahy, Easterby-Smith and Lervick (2013) find that bringing members of a cross-functional team into a single room improved collaboration within the team while simultaneously undermining relationships between team members and their functional areas. Building on Elsbach and Pratt’s argument, Kim and de Dear (2013) suggest that the small improvement in communication ease in open-plan offices is outweighed by a decline in individuals’ ability to minimise distractions, maintain privacy, and control interruptions. Through this dissertation, I contribute to the literature by showing that, for teams, the benefits of improved collaboration in the open-plan office can outweigh the negatives of distraction and limited privacy.

Study 3 uses a different data set to Study 1 and 2, and involves a comparative case-study of seven teams working in three different organisations (a university, a resources company and an insurance company). In Study 3, I find that when employees work in teams they benefit greatly from the instant information-sharing and informal coordination made possible in open-plan offices. Furthermore, teams are able to manage the negative impacts of distraction and a lack of privacy by communicating openly about these issues. Specifically, team members who share an open-plan office are able to learn about one another’s beliefs, values, preferences and knowledge and can adjust their behaviours to minimise conflict and work together effectively. Thus, by moving the focus from individual issues to team issues, I find that open-plan offices can have a positive impact on collaborative behaviour.

In summary, I address four main limitations in the existing literature. Firstly, I move the focus away from communication frequency, by exploring the process of collaboration in open-plan offices. Secondly, by examining how employees in open-plan offices develop new collaborative relationships, I challenge the assumption that chance encounters are the link between physical work environments and behaviour. Thirdly, to resolve the mixed empirical findings, I outline the conditions under which open-plan offices promote collaboration. Finally, I answer the call from Ashkanasy et al. (2014) to examine team issues in open-plan offices, by exploring team collaboration and examining the trade-off between individual and team issues in open-plan offices. Based on these four limitations, I answer four research questions.

1.4 Research questions

In this dissertation, I develop four research questions. These are as follows:
• Overall RQ: What is the relationship between open-plan offices and collaboration?
• RQ1: How do individuals develop new collaborative relationships in open-plan offices?
• RQ2: What are the conditions under which open-plan offices facilitate (and inhibit) collaboration?
• RQ3: How do teams collaborate in open-plan offices?

The research questions and their corresponding chapters are presented in Table 1.1. The overall research question is addressed across the dissertation and is the focus of Chapter 7’s Discussion. Research Questions 1, 2 and 3 are addressed in Study 1 in Chapter 4, Study 2 in Chapter 5, and Study 3 in Chapter 6 respectively (refer to Figure 1.1). Study 1 is a case study of open-plan offices in a collaborative building, Study 2 is a comparative case study of eight groups of employees in open-plan offices, and Study 3 is a comparative case study of seven teams that are located in open-plan offices. In the next section, I explain how each study addresses the relevant research question.

1.5 Research scope and design

The research that I outline in this dissertation is located within the critical realist paradigm (Bhaskar, 1998), because I sought to understand the relationship between individual’s subjective interpretations, the objective physical environment, and collaborative behaviours. I adopt an inductive, qualitative, comparative case study approach (Eisenhardt, 1989; Yin, 1994) that involves three studies. The selection of multiple cases enhances the rigour of this research, insofar as findings being replicated among multiple individuals, open-plan offices, and workgroups (Eisenhardt & Graebner, 2007). In addition, I used qualitative methods to directly observe how collaboration unfolded in the naturalistic setting of authentic open-plan offices (Lincoln & Guba, 1985). In the next paragraphs, I provide a brief description of the three empirical papers presented in Chapters 4, 5, and 6 of this dissertation.

I collected the data for Study 1 and 2 from employees who worked in a single collaborative science building. The building contains 20 open-plan offices. The building was constructed to bring together employees from three different government organisations so that they could pool resources, share laboratory space and equipment, and minimise the replication of projects. Employees from 17 different sites moved into a single building with the capacity to seat 1000 employees. The participants in Study 1 are scientists and support staff from the three organisations who occupy the open-plan offices in the collaborative science building. The three organisations are a state government department with a focus on applied research, a state government department
with a focus on scientific communication and legislative compliance, and a federal government agency with a focus on basic research.

Table 1.1 Research questions and corresponding chapters

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<tr>
<th>Chapter</th>
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<th>Research questions</th>
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<tr>
<td>Chapter 4</td>
<td>Study 1</td>
<td>RQ1: How do individuals develop new collaborative relationships in open-plan offices?</td>
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<td>Chapter 5</td>
<td>Study 2</td>
<td>RQ2: What are the conditions under which open-plan offices facilitate (and inhibit) collaboration?</td>
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<td>Chapter 6</td>
<td>Study 3</td>
<td>RQ3: How do teams collaborate in open-plan offices?</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>Discussion</td>
<td>Overall RQ: What is the relationship between open-plan offices and collaboration?</td>
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I gained access to the collaborative science building because I knew someone who was working in the building (a friend who was able to introduce me to a facilities manager). I observed employees in two of the collaborative building’s open-plan offices over a six week period. I also conducted semi-structured interviews with 40 employees from open-plan offices in different parts of the building. Initially, I thought the building would be suitable for an exploration of the impact of open-plan offices on employee’s wellbeing and productivity, because it contained 20 very similar open-plan offices. In contrast to existing research, where researchers compare differences between employee outcomes in open-plan and cell offices, I sought to understand differences between employee outcomes in open-plan offices (i.e. why do individuals have different outcomes in the same type of office).

During data collection, I became intrigued by the lack of interaction between employees from different organisations, and by the different levels of interactions between employees in different open-plan offices (employees joked about “quiet offices” and “noisy offices”). As is common in inductive qualitative research, I followed up on these interesting findings, by focusing on the process of collaboration as it unfolded in the building as a whole (Study 1) and in each open-plan office (Study 2). I present the data I collected from the collaborative science building in Study 1 (Chapter 4) and Study 2 (Chapter 5).

The aim of Study 1 is to answer Research Question 1, by examining the mechanisms through which physical work environments promote the development of new collaborative relationships. I analyse the data using inductive analysis and compare individuals who had and had not developed new collaborative relationships in the collaborative building. The results demonstrate that individual intentions shape how employees respond to the open-plan office. Specifically,
employees who wanted to collaborate were more likely to notice and take up opportunities for personal encounters than individuals who did not wish to collaborate.

Study 2 builds on the results of Study 1, allowing me to show how the schemas of individuals combine with the social and physical context of the open-plan office to facilitate or inhibit collaboration. The aim of Study 2 is to understand why open-plan offices sometimes promote and sometimes inhibit collaboration. In Study 2, I answer Research Question 2 through a comparative case study of collaboration in eight open-plan offices (four offices with high levels of collaborative behaviours, and four offices with low levels of collaborative behaviours). In Study 2 I use the same data set and analysis approach as Study 1, but focus on the observations and interviews that relate to ongoing collaborative behaviours among groups who share an open-plan office. The findings of Study 2 show that open-plan offices foster collaboration when the majority of people in the office want to collaborate.

Given that Studies 1 and 2 highlight how individual schemas and group context facilitate collaboration, in Study 3 I examine open-plan offices that are occupied by teams who have to collaborate to meet shared goals. To explore whether my observations from the open-plan offices in the collaborative science building generalised to other settings, I selected seven teams from three additional organisations. These organisations were a university, a resources company and an insurance company. To ensure that my sample included teams in the different open-plan offices described by Bodin-Daniellson and Bodin (2008), I had to select teams from organisations in different industries (i.e. higher education, resources and insurance). I found during the course of my research that different industries tend to use different types of open-plan offices. For example, in the Australian context, flex offices are common in banking and insurance, while small open-plan offices are common in universities. I gained access to the participating organisations through friends who were able to put me in contact with managers who worked in these organisations. In discussion with managers, I sampled teams that had shared goals and worked in open-plan offices. I obtained written consent from all team members who participated in my research.

The aim of Study 3 is to understand how teams use open-plan offices to collaborate. In Study 3, I answer Research Question 3 through a comparative case study of teams in open-plan offices. I selected seven teams to confirm whether or not the results from Studies 1 and 2 could be generalised for different industries, organisations, and open-plan offices. As in Studies 1 and 2, data collection included observation and interviews, and data analysis involved inductive analysis. The data consisted of six weeks of unstructured observations and 33 semi-structured interviews. Based on the results, I outline the processes by which teams in open-plan offices coordinate, cooperate, and share information.
1.6 Overview of the dissertation

In Figure 1.1 I present an overview of the research. In Chapter 2 I analyse the literature on collaboration and physical work environments. Based on the limitations of this literature, I propose situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013) as an alternative theoretical framework to conceptualise the physical work environment as a cognitive scaffold (Clark, 2008).

With this theoretical framework in mind, in Chapter 3 I outline methodological issues, including the ways in which situated cognition theory is consistent with the critical realism paradigm (Bhaskar, 1998), and with using a qualitative case study approach. In Chapter 3, I also justify the case study approach and outline the steps taken to maintain research quality.

In Chapters 4, 5, and 6, I present Studies 1, 2 and 3 as three discrete papers. In each of these chapters, I provide a short literature review, a detailed account of data collection and analysis procedures (e.g. setting, sampling, analysis software), a summary of key themes, and a discussion that outlines my theoretical and practical contributions. Finally, in Chapter 7, I provide an integrated discussion of the dissertation as a whole. The point of the final chapter is to return to the overall research question and explain the findings.
Figure 1.1 Overview of research
CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this dissertation, I aim to examine the relationship between open-plan offices and collaboration. With this aim in mind, I begin Chapter 2 by introducing situated cognition theory as a framework that explains collaborative behaviour as emerging from a combination of individuals, and social and physical factors. Next, I review the three main bodies of literature within the discipline of organisational behaviour that are most relevant to the current research: physical work environments, open-plan offices and collaboration. I provide a brief history of research on physical work environments and background to the claim that open-plan offices facilitate collaboration. I also discuss the difference between the psychologically grounded research on physical work environment and the sociologically grounded research on organisational space, and position my dissertation as contributing to research on physical work environments. I conclude the chapter with a discussion of the key limitations of literature on open-plan offices and collaboration.

2.2 Situated cognition theory

In order to understand the relationship between open-plan offices and collaboration, I draw on situated cognition theory. Rather than a theory in the traditional sense, Roth and Jornet (2013) describe situated cognition as a collection of assumptions about cognition that challenge the conventional view of cognition as being limited to internal mental representations of knowledge (i.e. schemas). Semin and Smith (2013: 125) argue that, adequate explanation of cognition requires an understanding of the interplay between behaviour, bodily structure, and environmental resources … rather than a focus on the isolated study of individual cognitive functions such as attention, memory, or learning.

Thus, the core assumption of situated cognition theory is that cognition is not confined to the “skin and skull”, but is a phenomenon that incorporates the physical environment, the social environment and human behaviour. Thus, situated cognition theory is relevant to my research on the relationship between open-plan offices and collaboration, because it describes how collective action (i.e. collaboration) unfolds in particular social contexts (i.e. teams) and physical contexts (i.e. open-plan offices).

As situated cognition theory has emerged from a number of different disciplines, interpretation amongst scholars varies. Given the location of this dissertation in the
organisational behaviour discipline, I adopt a version of situated cognition theory developed in social psychology (e.g. Semin, Garrido, & Palma, 2012; Semin & Smith, 2013; Semin, 1986; Smith & Semin, 2007; Sun, Semin, & Smith, 2002). Semin and Smith (2013) are the major proponents of situated cognition theory in social psychology. They focus on cognition as socially situated and understand it in the context of the physical environment. Semin and Smith critique the primacy of mental representations in traditional psychology, by arguing that mental representations are only one factor that shapes human action. They suggest that a full account of human cognition must incorporate social and physical context, as well as mental representations. In Semin and Smith’s view, researchers need to understand phenomena such as memory, decision-making, and learning, not only in terms of what is going on in individual minds, but also in terms of how these phenomena facilitate (or in some cases, inhibit) adaptive responses to physical and social contexts. Semin and Smith’s version of situated cognition theory is less radical than the alternative views advocated by philosophers and cognitive anthropologists, because it maintains the role of internal mental representations in cognition and action. I will briefly outline two alternative versions of situated cognition theory, before explaining how the theory relates to my research.

Clark (2008) is the key proponent of situated cognition theory in philosophy. Clark and colleagues argue that cognition is not just confined to an individual’s head but involves the body, other people and material objects (Clark & Chalmers, 1998; Clark, 2008; Wilson & Clark, 2006). As a thought experiment, Clark and Chalmers (1998) describe the cognitive process of mathematical calculation. If we were to perform this function in our heads, it would be traditionally conceptualised as a cognitive activity. We can, however, choose to count on our fingers, or use a calculator, to complete the same calculation outside our heads. Thus, Clark and Chalmers contend that the act of performing a calculation outside the head is a cognitive activity, just like performing the calculation inside the head. Similarly, Clark (2008) argues that we regularly offload onto the environment cognitive activities such as remembering and decision-making. He calls this process extended cognition. We can remember a friend’s phone number in our heads, or offload it onto the address book in our mobile phone. We can read about and weigh-up different insurance options in our heads, or we could input the features we want into a website, which can then select the best option.

Clark (2008: 17) has also argued that cognition rarely occurs “offline” and is more commonly “online”. Offline cognition involves traditional conceptualisations of cognition as representations of the world that are stored in the mind (Wilson, 2002). Cognitive activities such as planning and remembering require us to ignore our immediate surroundings and
focus inwards. In contrast, Clark suggests that most, if not all, cognition is online. From an evolutionary perspective, we have cognition so that we are able to adapt to our social and physical surroundings. When confronted with a situation (e.g. potential predator or prey), we do not represent this situation in our head to make sense of it, but respond using the physical (e.g. weapons, branches, stones) and social (e.g. other skilled hunters, warriors, weapon manufacturers) resources in our immediate environment. Although Clark has not explained how cognition is linked to collaboration, he has laid the groundwork for researchers who focus on cognition as socially distributed.

Hutchins (1980, 1991, 1995a, 1995b) draws on anthropological perspectives, and thus tries to understand cognition in its cultural and material context. Through an ethnographic study of a naval ship, Hutchins (1995b) shows how cognitive processes are offloaded onto crew members and material objects (e.g. maps, navigation instruments). Thus, he argues that cognition involves individuals coordinating their different perceptions of, for example, readings on instruments, geographical landmarks, and immediate weather conditions, to bring about actions that would have been impossible for an individual to achieve. Like Clark, to Hutchins (1995a) cognitive systems are not inside individual’s heads, but are composed of multiple individuals and physical objects. From this perspective, communication plays a central role in the cognitive system, because it provides people with access to each other’s perceptions. While Hutchins (1995b) acknowledges that individuals have mental representations in their minds, he argues that these play a minor part in broader cognitive systems and suggests that researchers should focus on the role of people’s actions, communications, and interactions with material objects to understand cognition. Overall, Clark’s and Hutchins’ interpretations of situated cognition theory were designed to show that cognition is a social and physical phenomenon, rather than just an individual and mental phenomenon.

Although scholars’ interpretations of situated cognition theory differ across disciplines, the theory is based on three core assumptions that make it relevant to my dissertation. The first assumption is that cognition is for action. From a situated cognition theory perspective, humans have cognitive abilities such as memory, attention, and learning, so that we can ensure our success and survival (Semin et al., 2012). Thus, cognition is not just about what goes on in our heads, but is reflected in the movement of our bodies (e.g. running, typing, weaving) and in verbal communication. Based on situated cognition theory, collaborative behaviour should be understood as a cognitive process. Thus, in this research, I explore how rather than how often people use open-plan offices to collaborate.
The second assumption of situated cognition theory is that cognition is socially distributed. Individuals do not only rely on our own memories, knowledge and perceptions to guide our actions, but communicate with other people to access their memories, knowledge and perceptions. Weick and Roberts (1993: 357), for example, have found that the process of landing an aircraft on the deck of a ship involves “heedful interrelating” between the pilot, air traffic controllers, landing signal offices, the control tower, navigators, deck hands and the helmsman driving the ship, among other people. Distributed cognition emerges at the system-level when individuals carefully, purposefully, and conscientiously orient their attention, actions and mental representations of a situation towards other people. Thus, to understand collaborative behaviours in open-plan offices, I examine the social relationships and interactions that enable individuals to share knowledge, coordinate and cooperate.

The final assumption of situated cognition theory is that cognition is extended onto the physical environment. Thus, Clark (1997) argues that the physical environment may be characterised as a “scaffold” for cognition because physical objects such as diaries and post-it notes can extend an individual’s capacity for remembering. Furthermore, as tools, technologies and equipment materialise the knowledge of those who created them, they can be used to translate knowledge across boundaries and scaffold collective cognition (Beckky, 2003a; Carlile, 2002). For example, Stigliani and Ravasi (2012) have found that product designers use material objects such as post-it notes, magazine cut outs, and diagrams to externalise their thoughts, and allow other team members to “see” what they are thinking. Thus, based in situated cognition theory, I suggest that open-plan offices may be conceptualised as a potential scaffold for team collaboration. Thus, collaboration involves individuals interacting with each other and with the physical environment.

In summary, in this dissertation, I advance a version of situated cognition theory that assumes cognition is for action, cognition is distributed, and cognition is extended. Consistent with these assumptions, I consider the social, physical and individual factors that underpin collaborative behaviour in open-plan offices. Situated cognition theory brings together these three assumptions to produce a holistic explanation of collaborative behaviour. In this dissertation I adopt Elsbach et al.’s (2005) definition of situated cognition as emerging from the interactions between schema and contexts. Schemas are mental models of the world that develop over a lifetime and which allow us to make sense in conditions of limited information (Walsh, 1995). For example, individuals have schemas about roles (e.g. I am a researcher, not a teacher), rules (e.g. it is appropriate to be noisy in an open-plan office) and people (e.g. Sandra is knowledgeable about finance). Context, on the other hand, relates to
the opportunities and constraints that impact on the meaning and occurrence of behaviour (Johns, 2006). For example, it is appropriate to have a noisy conversation in the context of a café, but less so in the context of a funeral.

In common with the schema theory of cognition (DiMaggio, 1997; Fiske & Taylor, 1991; Walsh, 1995), Elsbach et al. (2005) assume that schemas provide a framework for individuals to interpret their experiences. Schemas develop over a lifetime and are mental models about ourselves, other people, objects, and events that help us to make sense in conditions of limited information (Bourdieu, 1990; Walsh, 1995). Schemas help us to anticipate future events, and to respond appropriately (Fiske & Taylor, 1991). For example, if someone’s self-schema includes the idea that they are caring and socially conscientious, they might be compelled to give money when they see a homeless person. According to schema theory, we try to act consistently according to our schemas and often ignore information that contradicts them (Elsbach et al., 2005). Schemas are relatively stable and it can be difficult to change them, unless we are confronted with overwhelming evidence to the contrary (DiMaggio, 1997). For example, Labianca, Gray, and Brass (2000) found that a hospital struggled to implement participative decision-making processes, because employees retained schemas that only managers had the authority to make decisions. It was only when managers consistently modelled participative decision-making, that employees changed their schemas about decision-making processes and accepted the organisational change.

Yet, schema theory is limited because it predicts that individuals with similar schemas will have relatively consistent responses to similar situations. Empirical evidence, however, suggests that context can have a dramatic impact on our behaviour (Elsbach et al., 2005). We behave differently in different physical environments (e.g. a library compared to a bus stop), in different social groups (e.g. with professional colleagues compared to strangers), and in different organisations (e.g. a tennis club compared to a law firm). Johns (2006) argues that context can dramatically change the relationship between variables. For example, Johns (2006) suggests that high-quality training might have a positive impact on work outcomes if a boss is supportive of the changes induced by the training, but a different impact if the boss is not supportive. Thus, context plays a central role in shaping employee behaviour.

Based on Elsbach et al. (2005), neither schemas nor context alone shape our behaviour. Rather, as Semin & Smith (2013) argue, particular physical and social contexts trigger particular schemas, and schemas shape what individuals notice and respond to in a physical and social context. Firstly, context triggers particular schemas. For example, Norenzayan and Schwartz (1999) found that individuals who were asked to complete a
survey on the causes of crime reported dispositional explanations when the survey was badged “Institute for Personality Research”, and situational explanations when the research was badged “Institute for Social Research” (Norenzayan & Schwarz, 1999). Their results suggest that different schemas (dispositional verses situational accounts on what causes crime) are triggered by different contexts (the word “personality” verses “social”), and that this process impacts subsequent behaviour (what people write on a survey). Thus, the activation of schemas can explain why individuals have different responses to the same stimuli in different contexts.

Secondly, the things we notice and respond to are contingent on our schemas (Smith & Semin, 2004). In a classic experiment, Pichert and Anderson (1977) told participants that they were potential homebuyers or robbers and then asked them to read a story about walking through a house. Potential homeowners were more likely to remember a leaking roof, whereas potential robbers were more likely to recall a large television. In this experiment, Pichert and Anderson found that participants tended to notice and remember things that were likely to be relevant to potential future actions (Smith & Semin, 2004). Similarly, Pickett, Gardner and Knowles (2004) have demonstrated that individuals who were experiencing a strong need to belong paid more attention to social cues, such as vocal tones and expressions of emotion. Thus, the idea that individuals have different schemas can explain why two people may have very different responses to the same stimuli in the same context.

In summary, given situated cognition theory, specific combinations of schemas and contexts come together at particular times and places to shape individual understandings of that situation (Elsbach et al., 2005). These “situated cognitions” inform individuals’ subsequent behaviour. Thus, based on situated cognition theory, I argue that collaborative behaviour emerges from a combination of, (1) schemas that relate to collaboration (e.g. an individual’s mental model about their work roles or about other people), (2) specific physical contexts (e.g. the open-plan office) and (3) specific social contexts (the relationships between people who share an open-plan office). I use situated cognition theory to explain the relationship between open-plan offices and collaboration, and to account for the interplay of individual, social and physical factors. In the rest of the chapter, I outline key limitations of the existing literature on physical work environments, open-plan offices, and collaboration. In this dissertation, I address these limitations by adopting situated cognition theory, and by focusing on the individual in their social and physical context.
Physical work environments encompass all of the material objects and stimuli that people encounter and interact with at work, as well as the distribution and movement of these objects and people in relation to each other (Elsbach & Pratt 2007). This includes buildings, furniture, lighting, air quality, office layouts, meeting rooms and breakout areas (Elsbach & Pratt 2007). Although early research in scientific management emphasised the importance of spatial layout, tools and equipment in promoting efficient work flow (Taylor, 1911), this interest in physical work environments was not sustained through the middle of the twentieth century. Specifically, the landmark studies at the Western Electric Hawthorne Works suggested that employee morale and productivity was more closely linked to the personal and social needs of employees than to physical aspects of the factory environment (Mayo, 1949; Roethlisberger & Dickson, 1939). These findings encouraged researchers to focus on social and psychological antecedences to organisational behaviour, rather than physical ones (Sutton & Rafaeli, 1987).

Although the physical work environment was mostly ignored within organisational behaviour throughout the middle of the twentieth century, in the 1970s and 1980s a number of key studies were published which examined the influence of office environments on co-worker relations (Oldham & Brass, 1979; Oldham & Rotchford, 1983), communication (Allen, 1977; Hatch, 1987; Sundstrom, Herbert, & Brown, 1982), satisfaction (Oldham, 1988; Sundstrom, Burt, & Kamp, 1980) and productivity (Block & Stokes, 1989; Crouch & Nimran, 1989; Sundstrom & Sundstrom, 1986). The focus of these studies was on the ways in which aspects of the physical work environment, including proximity (Monge, Rothman, Eisenberg, Miller, & Kirste, 1985), privacy (Davis & Altman, 1976; Sundstrom, Town, Brown, Forman, & McGee, 1982) and office layout (Hedge, 1982; Oldham & Brass, 1979; Zalesny & Farace, 1987) influenced employee behaviour and attitudes. These studies laid the foundations for research in the 1990s and 2000s that focused more on the symbolic (Hatch, 1993), aesthetic (Strati, 1992) and meaningful (Rafaeli & Vihai-Yavetz, 2004; Vihai-Yavetz, Rafaeli, & Yaacov, 2005; Yanow, 1998) aspects of physical work environments, including their relationship with corporate culture (Hatch & Schultz, 1997).

In the past fifteen years, interest in physical work environments has grown, with the publication of several books within the organisational behaviour and organisational studies fields (Clegg & Kornberger, 2006; Dale & Burrell, 2008; Hernes, 2004; Van Marrewijk & Yanow, 2010). Researchers have imported theoretical perspectives from outside of
organisational behaviour, and have begun to produce richer and more complex accounts of the physical work environments by focusing on issues such as identity and power (Dale, 2005; Elsbach, 2003, 2004; Hirst, 2011). Rather than viewing physical work environments as simply influencing employee behaviour, researchers have drawn on the concept of organisational space to foreground the active role that people have in physically building, maintaining, neglecting and modifying physical work environments, as well as in socially constructing the meanings, norms and values associated with them (Dale & Burrell, 2008; Kornberger & Clegg, 2004).

In 2007, two significant reviews of research on physical work environments were published that set the agenda for current research in the field: firstly, Taylor and Spicer’s (2007) review of organisational space, which was published in the International Journal of Management Reviews; and secondly, Elsbach and Pratt’s (2007) review of physical work environments, which was published in the Academy of Management Annuals. Although I use and build on the terminology described by Elsbach and Pratt, I will briefly outline Taylor and Spicer’s argument and locate my research in their framework.

Taylor and Spicer (2007) use the term organisational space rather than physical work environment, suggesting it is a more inclusive term. They developed a framework that classified existing research on space, place, buildings, and physical environments in organisations into three categories based on how researchers had understood organisational space. The first understanding is of Space-as-Proximity and includes research that focuses on the physical features of the work environment, such as barriers, layout, and distance. The second understanding is of Space-as-Experience, and includes research on people’s perceptions of physical features, and on the meanings they attribute to those features. Finally, researchers who understand Space-as-Materialised-Power-Relations have explored issues of power, control and the social construction of physical work environments. Overall, Taylor and Spicer (2007) draw on the work of philosopher Henri Lefebvre (1991), to argue that space should be understood as simultaneously involving proximity, experience and power. The framework developed by Taylor and Spicer remains highly influential in the organisational studies discipline (e.g. Lawrence & Dover, 2015; Rowe, 2015; Shortt, 2015).

Although I acknowledge the theoretical perspectives outlined by Taylor and Spicer, the primary contribution of this dissertation is not to research on organisational space. Instead I contribute to the literature on the physical work environment, as described by Elsbach and Pratt (2007). Elsbach and Pratt (2007: 181–182), define the physical work environment as “material objects and stimuli… as well as the arrangements of those objects and stimuli”,

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which is consistent with Taylor and Spicer’s (2007) categorisation of Space-as-Proximity. Elsbach and Pratt’s main argument is that there is no single set of physical features or arrangements (e.g. high verses low enclosure, natural verses unnatural setting) that will consistently produce desired outcomes (e.g. collaboration, performance, wellbeing), so managers must select physical features that trade-off beneficial outcomes with negative side effects. For example, open-plan layouts may improve communication, but simultaneously undermine concentration and privacy (Kim & de Dear, 2013). Thus, the scholars reviewed by Elsbach and Pratt were mainly concerned with understanding the relationship between physical features and behaviour, with a view to predicting organisational outcomes.

Consistent with Elsbach and Pratt (2007), in this dissertation I seek to understand the relationship between physical work environments and behaviour, by drawing on psychological concepts and theories. Thus, I do not explicitly address issues such as meaning and power, which are of interest to researchers who study organisational space (e.g. Dale, 2005; Hirst & Humphreys, 2013; Zhang & Spicer, 2013). Instead, my focus is to explore the relationship between one kind of physical work environment, the open-plan office, and one kind of behaviour, collaboration.

Although there are studies on diverse physical work environments, such as hospitals (Värlander, 2012), factories (Bernstein, 2012), and hairdressing salons (Shortt, 2015), office environments continue to be of substantial interest for researchers who study physical work environments. Many of the significant 1970’s and 1980’s studies of physical work environments compared cell and open-plan offices (e.g. Hatch, 1987; Oldham & Brass, 1979; Oldham & Rotchford, 1983; Sundstrom et al., 1980). Furthermore, recent research has focused on issues such as the relationship between office personalisation and productivity (Nieuwenhuis, Knight, Postmes, & Haslam, 2014), the impact of standing desks on creativity (Knight & Baer, 2014), and the emotions and behaviours expressed by employees in open-plan offices (Ashkanasy et al., 2014). Thus, within the broader literature on physical work environments, open-plan offices have been of particular interest to researchers.

As outlined in the introduction to this dissertation, the reasons for focusing on collaboration in open-plan offices are fourfold. Firstly, practitioners regularly make claims that open-plan offices support collaboration, even though there are only two studies that examine this issue (Hua et al., 2010; McElroy & Morrow, 2010). Secondly, research on the relationship between open-plan offices and constructs related to collaboration (e.g. interaction, cooperation, communication), has produced mixed findings, suggesting that there is no simple correlation between the openness of a space and collaborative behaviours (De
Croon et al., 2005). Thirdly, researchers have tended to examine interaction in established workgroups, rather than the development of new collaborative relationships (e.g. Brennan et al., 2002; Hatch, 1987; Oldham & Brass, 1979), even though one of the main reasons organisations adopt open-plan offices is to reduce barriers to cooperation across departmental and organisational boundaries (e.g. Thurm, 2005). Finally, Ashkanasy et al. (2014) have called for the examination of team issues in open-plan offices: particularly the team processes that may explain some of the tensions, paradoxes and mixed findings associated with open-plan offices.

In this dissertation, I focus on the team process of collaboration. Thus, based on Rousseau, Aube and Savoie (2006), I define collaboration as a collective behaviour involving cooperation, coordination and information sharing. Given my focus on collaboration in open-plan offices, in the next section I provide a brief history of the open-plan office and explain how ideas about the link between open-plan offices and collaboration have developed over time.

2.3.1 History of open-plan offices

An open-plan office is a shared room occupied by more than four people, where desks are arranged in groups, and where there are few barriers between desks (Bodin-Danielsson & Bodin, 2008). The contemporary open-plan office, in its diverse forms, can trace its roots back to open-plan offices of the early twentieth century (Baldry, 1997). Although the kinds of office layout adopted in different countries have varied considerably over the last 120 years (Duffy, Laing, & Crisp, 1993), I focus on the three broad trends in the USA and Europe that have had the greatest influence on current open-plan office design. These are the bull-pen, the landscape office and cubicles.

Hofbauer (2000) argues that bull-pen open-plan offices became prevalent in the 1930s when Taylorist 1 approaches to spatial layouts were dominant. During this phase, the open-plan office mirrored a factory, and desks were lined up in rows that all faced in the same direction (Savil, 2010). The typical office worker was imagined to be a clerical worker who produced standardised output and could be easily substituted (Baldry & Barnes, 2012). Early open-plan offices typically lacked barriers and were environments where employees could be

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1 Taylorism (also known as Scientific Management) was an approach to management advocated by Frederick Taylor that involved analysing workflow and the movements of employees (Statt, 2004). Unnecessary movements were eliminated to increase efficiency and productivity (Statt, 2004). Taylor’s work was most commonly associated with manufacturing and the factory context, but was later incorporated into office design (Greene & Myerson, 2011).
under constant surveillance by managers, thus subject to the “panoptical gaze” (Foucault, 1977). Thus, the open-plan office symbolised strict hierarchical power relations between managers and employees (Baldry, 1997). In terms of collaboration, Hofbauer (2000) argues that bull-pen layouts were supposed to enhance formal communication and workflow, while simultaneously undermining the ability of employees to socialise with their colleagues. Employees faced away, rather than towards one another and could not easily make eye contact, which created an environment where co-workers were indifferent towards one another (Hofbauer, 2000).

As a reaction against the alienation of bull-pen open-plan offices, the Bürolandschaft (or landscape office) was invented in Germany in the 1950s (Baldry & Barnes, 2012). In this phase of office design, plants and natural elements were brought into the office to demark groups of workers and provide some privacy (Baldry, 1997). Hofbauer (2000) suggests that the layout and aesthetics of the landscape office were consistent with popular management theories in the 1950s. Theories based on Human Relations principles emphasised the wellbeing of the worker. The typical employee was now imagined to be a white-collar professional who could perform their job without close supervision from managers (Baldry, 1999). In terms of collaboration, the landscape office was associated with the idea that organisational outputs emerged from the efforts of teams rather than individuals (Hofbauer, 2000). Thus, unlike the bull-pen offices, in which informal interactions were discouraged, the landscape office was arranged to facilitate both informal and formal interaction, both of which were viewed as essential aspects of work (Hofbauer, 2000). Desks were arranged in groups to generate feelings of accessibility and to facilitate communication within teams (Brennan et al., 2002).

In response to the lack of individual privacy in landscape offices, many organisations adopted the cubicle open-plan office in the 1970s (Savil, 2010). Savil (2010) describes how cubicles were invented in 1968 by Robert Propst for the furniture company, Herman Miller. Propst hoped to provide employees with work spaces where they could have both privacy and a view, and envisioned joining the cubical panels at 120 degrees, to give employees a clamshell-shaped work space. In reality, managers quickly realised they could join cubicles at a 90 degree angle to fit more people onto each floor (Aronoff & Kaplan, 1995). Cubicles became a replacement for private cell offices, and managers could cheaply provide professional employees with “private” spaces (Savil, 2010). Although cubical offices were supposed to allow employees to balance individual and collaborative work, they actually undermined both (Hofbauer, 2000). Employees in cubicle offices had visual privacy, but little
acoustic privacy, which meant they suffered from distractions, difficulty concentrating and lowered productivity (Kim & de Dear, 2013). Furthermore, employees could not see the body language of people on the other side of the cubicle wall, and thus could not easily realise the implications of their behaviour on other people in their office space (Kim & de Dear, 2013). Thus, cubicles undermined individual concentration, and also inhibited the possibility of positive collegial relationships (Hofbauer, 2000). Employees avoided collaboration and came to view each other as potential distractions.

In reaction to the limitations of cubical offices, another movement has emerged towards open-plan offices with few physical barriers between employees (Waber, Magnolfi, & Lindsay, 2014). As in the past, these changes reflect dominant assumptions about the nature of work and how employees should best be managed (Baldry, 1997). Today, there are three competing accounts of the open-plan office presented in popular media and academic literature. I refer to these perspectives as the lean open-plan office, the fun open-plan office, and the cynical view of the open-plan office.

2.3.2 Contemporary accounts of the open-plan office

The first account of the open-plan office relates to the idea of the lean office (Knight & Haslam, 2010). Lean open-plan offices are most closely aligned to the Taylorist offices of the early twentieth century (Baldry, 1999). The lean office is usually a flex office where there is little personal space and where employees are supposed to sit in a new desk each day (e.g. Elsbach, 2003; Hirst, 2011; Warren, 2006). Flex offices are underpinned by the assumption that at least thirty percent of employees are out of the office each day (e.g. on leave or doing client work) (Bodin-Danielsson & Bodin, 2008). Thus, organisations can adopt a smaller floor plan and minimise their real estate costs by only providing desk space for the other seventy percent of employees (Bodin-Danielsson & Bodin, 2008). By limiting personalisation, lean offices are also supposed to eliminate distractions. In the lean office, both employees and the office are supposed to be flexible (Knight & Haslam, 2010).

With regard to collaboration, employees in lean offices are supposed to be agile and flexible; changing roles, changing spaces, and moving between departments, as the organisation responds to a rapidly changing external environment (Bodin-Danielsson & Bodin, 2008). Portable technologies such as tablets, laptops, and smart phones mean that employees do not have to be in the office to work (Brocklehurst, 2001). Employees may combine working from home and working from the office and are expected to communicate just as effectively through corporate social media, email, and online chat, as they can face-to-
face (Bean & Hamilton, 2006). In fact, Hirst (2011) argues that in flex offices, employees tend to avoid face-to-face interactions with those who sit in their immediate environment, being very careful to avoid making eye contact or talking with one another. Instead employees sit at their individual desks and communicate with others through technology. Thus, lean offices provide the minimum resources required for efficient work and are not necessarily associated with face-to-face collaboration.

In contrast, the second contemporary account of the open-plan office, as a “fun” environment, is synonymous with collaboration (Thanem & Värlander, 2014). Fun open-plan offices are most closely linked to the landscape offices of the 1950s. The archetype of contemporary, fun open-plan offices is of those occupied by large technology companies in Silicon Valley (Thanem, Värlander, & Cummings, 2011; Waber et al., 2014). Employees are provided with a variety of spaces, such as games areas, cafes, and yoga rooms that are supposed to generate creativity and promote innovation (McCoy & Evans, 2002; Zoller & Boutellier, 2013). The fun open-plan office symbolises egalitarian values and a flat organisational structure, where everyone from the CEO to the intern all sit at similar desks and share a single space (Heerwagen et al., 2004). In 2015, when Facebook moved into the largest open-plan office in the world, CEO Mark Zuckerberg commented that the office space was designed to enhance communication and interactions, which he viewed as essential for collaboration (Frankel, 2015).

Employees in fun open-plan offices are supposed to be egalitarian, accessible and open to interacting with one another (Baldry, 1997). Office spaces are designed with shared kitchen areas and spaces for relaxation that are supposed to enhance chance encounters and facilitate informal interactions between people from different parts of the organisation (Boutellier et al., 2008). Face-to-face communication is considered very important, and even though employees may engage in some virtual communication with others, there is a strong emphasis on employees being present in the office (Collinson & Collinson, 1997). For example, in justifying their ban on homeworking, the chief HR office at Yahoo released a memo stating,

> to become the absolute best place to work, communication and collaboration will be important, so we need to be working side-by-side. That is why it is critical that we are all present in our offices (Arthur, 2013: 1).

Thus, the fun open-plan office is associated with the expectation that employees are present, available, and highly committed to the organisation (Fleming & Spicer, 2004).
Fleming and Spicer (2004) argue that the ideology associated with “fun” and “collaborative” open-plan offices can blur the spatial boundaries between inside and outside of work, and can have negative effects. In their study of call centre-workers in a “high-commitment organisation”, they argue that managers use space as a way of bringing activities not usually associated with work (e.g. casual dress codes, party atmosphere, costume days, field trips to the theatre) into the workplace. Furthermore, managers encourage employees to socialise together and regularly hold meetings in cafes, parks and other spaces. Fleming and Spicer argue that the ideology of a “fun” and “collaborative” work environment can result in the intrusion of work into private life and inhibit employees carrying out their personal interests and family roles. Although managers may foster an environment for collaboration in the “fun” office, employees who want to opt out of this culture may find themselves excluded.

Unlike proponents of the fun open-plan office, subscribers to a cynical account of the open-plan office are suspicious of the idea that open-plan offices facilitate collaboration (Kim & de Dear, 2013). The cynical account of the open-plan office is associated with the logic behind the cubical and cell offices of the 1980s, and focuses on the negative impact of open-plan offices on employees (Savil, 2010). In this account, open-plan offices hinder employee wellbeing and productivity because they fail to provide employees with private spaces where they can concentrate and work alone (Kaarlela-Tuomaala et al., 2009). In a review of newspaper articles about open-plan offices, Ashkanasy, Ayoko and Waddell (2013) found that negative impacts of open-plan offices on privacy and distraction were mainly voiced by employees, while positive views of open-plan offices, in terms of their potential to enhance collaboration and performance, were most strongly associated with managerial viewpoints (see also Baldry, 1997).

In the cynical view, any claim that open-plan offices promote collaboration is treated with cynicism or viewed as hindering productivity. For example, in the Washington Post, Kaufmann (2014: 1) suggests that, “while employees feel like they’re part of a laid-back, innovative enterprise, the environment ultimately damages workers’ attention spans, productivity, creative thinking, and satisfaction”. There is some evidence to suggest open-plan offices facilitate less interaction and collaboration than cell offices (De Croon et al., 2005). For example, Hatch (1987) has found that employees with private offices spend more time communicating than employees in open-plan spaces. She argues that privacy facilitates open, honest and lengthy conversations, because employees feel they are better able to control the boundaries of their conversations. Värlander (2012) also suggests that employees...
in open-plan offices tend to worry about distracting their colleagues. She has found that rules emerge in open-plan offices that restrict employees’ willingness to interact. Overall, based on the cynical view, the negative impact of open-plan offices on distraction, privacy, and employee control, far outweigh any real or imagined improvement in collaboration (Kim & de Dear, 2013).

In summary, these three contemporary accounts present different views on the relationship between open-plan offices and collaboration. While advocates of the fun open-plan office have argued that removing physical barriers enhances communication and chance face-to-face interactions (Waber et al., 2014), proponents of lean offices have been interested in promoting efficacy, rather than collaboration (Nieuwenhuis et al., 2014). Alternatively, advocates of the cynical perspective describe the link between open plan offices and collaboration as rhetoric rather than reality (Kaufman, 2014). Given these competing accounts of collaboration in open-plan offices, in this dissertation, I seek to re-evaluate the relationship between open-plan offices and collaboration.

2.4 Current debates on open-plan offices

Open-plan offices are at the centre of popular and academic debate about the relationship between physical work environments and organisational outcomes (Ashkanasy et al., 2014; Elsbach & Bechky, 2007; Elsbach & Pratt, 2007). Debate has focused on whether open-plan offices deliver positive outcomes such as improved communication, collaboration and creativity, or undermine privacy, productivity and wellbeing (Kim & de Dear, 2013; Thanem et al., 2011). The focus of the existing discussion has been on evaluating the impacts of open-plan offices on individuals (e.g. Bodin-Danielsson & Bodin, 2008; De Croon et al., 2005), rather than on understanding the circumstances under which open-plan offices may support group processes.

When it comes to the link between open-plan offices and outcomes, the research is full of contradictory findings (De Croon et al., 2005). For example, in terms of performance, Oldham, Kulik and Stepina (1991) find that open-plan offices reduce employee performance on simple tasks and improve performance on complex tasks, while Block and Stokes (1989) find that performance is better in a private setting for those working on complex tasks and in a non-private setting for those working on simple tasks. With regard to satisfaction, Brennan et al. (2002) find that employees who move from cell offices to open-plan offices experience a decline in satisfaction, while McElroy and Morrow (2010) find that moving to a new open-plan office space leads to improved satisfaction. More broadly, the empirical evidence has
made it clear that open-plan offices do not consistently promote particular outcomes. The most inconsistent evidence relates to outcomes such as communication, interaction and the quality of collegial relationships (De Croon et al., 2005).

Given these issues, Ashkanasy et al. (2014) called for researchers to go beyond identifying tensions and paradoxes, to examine the processes that lead open-plan offices to promote different outcomes. In this dissertation, I answer the call to explain tensions and surprises in open-plan offices by exploring the process of collaboration as it unfolds. I chose to focus on collaboration because one of the main claims made by advocates of open-plan offices is that open-plan offices improve collaboration (Vischer, 1999, 2006). Furthermore, researchers, such as Boutellier et al. (2008), have suggested that the main way office space can shape organisational outcomes, such as innovation and performance, is by changing the patterns of communication among employees (see also Monge et al., 1985; Waber et al., 2014). Specifically, by removing physical barriers, open-plan offices are also supposed to remove social barriers (Thurm, 2005). Thus open-plan offices should promote more frequent and effective communication within workgroups and between workgroups, helping to break down boundaries and encouraging collaboration among people who may not otherwise have worked together (Waber et al., 2014).

Despite these claims, I am aware of only two empirical studies that have explicitly examined the relationship between collaboration and open-plan offices. Hua et al. (2010) explore the physical features that employees perceive as conducive to collaboration (e.g. distance to meeting rooms), while McElroy and Morrow (2010) find that employees perceive the organisational culture as more collaborative after moving from one open-plan office to a newer, denser open-plan office. Both of these studies suggest that open-plan offices can have an impact on collaboration. They focus, however, on employees’ perceptions of collaboration rather than actual collaborative behaviours. This means that existing research has told us little about how or why the process of collaboration may lead to different outcomes in open-plan offices.

Furthermore, research on constructs related to collaboration has resulted in mixed findings. Researchers have examined variables such as interaction frequency and duration (Ullman & Boutellier, 2008), perceptions of communication ease (Sundstrom, Herbert, et al., 1982), satisfaction with communication (Kim & de Dear, 2013), and satisfaction with collegial relationships (Kaarlela-Tuomaala et al., 2009). These variables have typically been conceptualised as an outcome and measured either through direct observation (i.e. counting interactions) or through surveys and diaries (i.e. employees’ perceptions). While several
studies have indicated a positive relationship between open-plan offices and communication (Allen & Gerstberger, 1973; Boutellier et al., 2008; Brennan et al., 2002), other researchers have found negative (Hatch, 1987; Kaarlela-Tuomaala et al., 2009; Pepper, 2008) or neutral (O’Neill, 1994) relationships. In light of the unclear relationship between open-plan offices and communication (as well as other outcome variables such as performance and innovation), researchers have proposed a number of explanations. In the next section, I will outline these explanations and show that they cannot fully explain the relationship between open-plan offices and collaboration.

2.4.1 Insights from the literature on physical work environments

In attempting to explain why open-plan offices are associated with inconsistent outcomes, researchers have focused either on physical features of the office, on social explanations, or on individual explanations. In this dissertation I contend that each of these perspectives offer incomplete insights. After outlining each perspective, I argue that there is a need to theorise collaborative behaviour as emerging from a combination of physical, individual and social factors.

Some researchers have focused on the role of physical features as shaping interactions in open-plan offices (Waber et al., 2014). Fayard and Weeks (2007) argue that researchers have tended to either focus on propinquity or privacy as the key physical antecedent to communication. Researchers who take a propinquity perspective argue that a short distance and minimal barriers between desks can facilitate collaboration by providing opportunities for employees to engage in spontaneous encounters (Zoller & Boutellier, 2013). For example, in their classic study, Allen and Gerstberger (1973) demonstrated that employees communicated almost exclusively with others who sat within 30 meters of their desk. They suggested that minimising barriers such as walls, doors, and stairs could increase the frequency of interaction and improve communication (see also Boutellier et al., 2008; Monge et al., 1985; Zahn, 1991).

In contrast, other researchers have argued that private physical contexts enhance collaboration because employees are able to express themselves honestly and at length without being overheard (Sundstrom, Herbert, et al., 1982). In support of this perspective, Hua et al. (2010) find that employees perceive office environments as more collaborative when their desks are located closer to meeting spaces, further away from distracting kitchen and printing areas, and where a greater percentage of the floor space is dedicated to meeting spaces. Thus, open-plan offices may undermine collaboration because they do not provide
employees with the privacy required for meaningful interaction (Hatch, 1987; Sundstrom, Herbert, et al., 1982). Researchers who have focused on the physical element of proximity have argued that open-plan offices promote collaboration, while those who focus on privacy have suggested that open-plan offices undermine collaboration (Fayard & Weeks, 2007). However, empirical research has not provided clear support for either perspective.

As one way of resolving the debate between privacy and proximity in open-plan offices, Elsbach and Pratt (2007) take a tensions and trade-offs perspective. They argue that workspaces with more enclosures and barriers (i.e. not open-plan), for example, will generally result in improved satisfaction for managers and professionals, improved performance on simple tasks, and improved health outcomes. In contrast, they suggest that workspaces with lower barriers will generally result in improved satisfaction for clerical workers, improved performance on complex tasks, and improvements in task identity for all employees. Practitioners should choose the outcomes they wish to maximise and select an office space that is most likely to maximise these outcomes. Consistent with the tensions and trade-offs perspective, Kim and De Dear (2013) argue that the small, positive impact of open-plan offices on communication ease is outweighed by the negative impact of open-plan offices on privacy and noise levels.

The main limitation of the tensions and trade-offs perspective is that it assumes open-plan offices are consistently associated with particular outcomes and that it is a matter of deciding whether the positive outcomes (e.g. communication ease) outweigh the drawbacks (e.g. distractions) for a particular group of employees (e.g. managers, clerical employees, professionals). Although the tensions and trade-offs approach effectively demonstrates that no one type of office (e.g. open-plan, cell, activity-based) is better than another in every situation, it does not confront the inconsistent research findings that have shown no clear relationship between open-plan offices and specific employee outcomes, particularly when it comes to collaboration (see De Croon et al., 2005). In light of these mixed findings, simply focusing on the physical elements of the open-plan office is unlikely to provide a full account of the relationship between open-plan offices and collaboration.

Consideration of social context provides a second way of exploring why open-plan offices sometimes inhibit and sometimes promote collaboration. In this regard, Fayard and Weeks (2007) use the example of photocopier rooms to challenge the idea that physical features cause behaviour. Instead, they argue that a combination of physical and social factors shape interaction. They draw on affordances theory (Gibson, 1979) to argue that physical features do not determine behaviour but make certain behaviours possible.
suggest physical spaces with features that promote both propinquity (e.g. central location), and privacy (e.g. enclosure) afford interaction. Critical to their argument is the idea that the social designation of a space combines with its physical features to enable and constrain behaviour. For example, in some organisations it is common for all employees to photocopy, while in others it is the role of administrative employees. In the former organisation, the social designation of the space created an environment where many different employees were able to freely come into the photocopier room and experience opportunities to interact, while in the latter organisation it was perceived as strange for non-administrative employees to be in the photocopier room. Thus, Fayard and Weeks’s core argument is that physical features may enable and constrain behaviour, but it is ultimately social context that shapes how people use a physical work environment and thus the kind of outcomes that the physical work environment generates.

Other researchers have also argued that social contexts shape how employees respond to physical work environments, and thus the kind of outcomes open-plan offices promote. Pepper (2008), for example, has found that employees are unwilling to use areas designated for interaction until managers make it clear that they sanction informal communication. Similarly, Värlander (2012) has demonstrated that in open-plan offices, social rules quickly emerge to limit people’s interaction with one another. Employees developed and policed norms related to talking loudly and talking on the phone, which limited the flexibility of the space and employees’ behaviour, the outcome the organisation was trying to promote. Finally, Hirst’s (2011) study of employees in a flex office has also demonstrated that relationships between employees shape face-to-face interactions. Unlike in a traditional open-plan office where employees have a designated desk and sit with the same group of colleagues each day, employees in the flex office were supposed to move to a new desk each day. As a result, they were unable to develop the rapport required to feel comfortable interacting with the people around them. Overall, researchers have demonstrated the importance of social context (e.g. norms, relationships) for shaping employee interactions in open-plan offices.

The main limitation of research that focuses on social context as shaping collaboration in open-plan offices (or on a combination of physical and social factors), is that it does not account for variations in individual responses to open-plan offices. Although they refer to individual agency, Fayard and Weeks (2007) do not explain why individuals from the same workgroup or organisation (and subject to the same social norms) may differ in the way they respond to similar physical work environments. Yet, there is some research on differences
between employees which demonstrates that individual factors, such as an employee’s age
(McElroy & Morrow, 2010), role (Brennan et al., 2002), and ability to screen out noise
(Fried, 1990), shape individual experiences in open-plan offices. Thus, integrating social
context to explain employee responses to open-plan offices goes beyond the simple
assumption that physical features cause behaviour. But it does not fully explain collaborative
behaviour.

Finally, to resolve mixed findings on the outcomes of open-plan offices, researchers
have focused on individual differences. Existing research is not directly relevant to
collaboration in open-plan offices, as scholars have focused on outcomes such as satisfaction,
performance and wellbeing. Yet, relevant to my research is the idea that individual
characteristics, roles and preferences may shape responses to the open-plan office.
Researchers have shown that individual characteristics such as personality, demographics
(gender, age, tenure, education), and screening ability can shape employees’ outcomes in
open-plan offices (Block & Stokes, 1989; Fried, 1990; McElroy & Morrow, 2010). For
example, Maher and von Hippel (2005) have found that individuals with the ability to tune
out from irrelevant stimuli tend to experience greater satisfaction and performance in open-
plan offices. Furthermore, individuals working on different kinds of tasks, in different kinds
of roles, and in different places in the organisational hierarchy, have experienced different
outcomes in open-plan offices. For example, Carlopio and Gardner (1992) have discovered
that clerical workers experience improved satisfaction in more open office environments,
while managers and professionals tend to have more negative experiences. Overall, research
on individual issues in open-plan offices suggests that individual factors will contribute to
employee behaviour.

Yet, the research on individual issues in open-plan offices has some limitations.
Firstly, existing research tends to focus only on physical context and individual issues,
without simultaneously accounting for social context. Thus we know little about how
different individuals in the same open-plan office might respond to an open-plan office that is
full of people they know, or full of people who are strangers, for example. Yet, we know
from research on teams that the composition of individuals with different characteristics does
shape collaborative behaviours (e.g. Woolley, Gerbasi, Chabris, Kosslyn, & Hackman, 2008).
Secondly, by focusing on individual characteristics and tasks, scholars have ignored the role
of individual cognition and mental schemas in shaping employees’ responses to the open-plan
office.
Yet, empirical research has demonstrated that individual schemas underpin team collaboration (DeChurch & Mesmer-Magnus, 2010). For example, when team members have accurate mental schemas about each other’s knowledge, they are better able to allocate tasks and seek information from team members with appropriate expertise (Lewis & Herndon, 2011; Lewis, 2003). Thus, while researchers know that the composition and schemas of individuals underpin collaborative behaviours, researchers who study open-plan offices have not explored how this relates to collaborative behaviours.

Overall, researchers who study open-plan offices have tended to focus on physical, social, or individual explanations for why open-plan offices have positive, neutral, or negative impacts on interaction. This means that researchers appear to have produced partial understandings of whether or not open-plan offices will have a positive or negative impact on the amount of interaction, and can tell us little about the reasons people are interacting or the content of their interactions. We know that open-plan offices sometimes promote and sometimes inhibit interactions (De Croon et al., 2005), and that this may be influenced by the physical context (Hatch, 1987), social context (Fayard & Weeks, 2007), and individual factors (Fried, Slowik, Ben-David, & Tiegs, 2001).

Given these mixed findings, it seems that we have no overarching understanding about when and how open-plan offices shape collaborative behaviours. The literature on collaboration addresses some of these limitations, and provides further insight into the nature of the relationship between physical work environments and collaboration. Thus, in the next section, I discuss how collaboration researchers have addressed issues related to the physical work environment and collaboration.

2.4.2 Insights from the literature on collaboration

Having examined what we know about the relationship between physical work environments and collaboration in the literature on physical work environments and open-plan offices, I now turn to the literature on collaboration. In general, researchers have focused on the social and individual antecedents and processes involved in collaboration, rather than the physical context (e.g. Bruns, 2013; DiBenigno & Kellogg, 2014; Sytch & Tatarynowicz, 2013). Yet there are three main areas of the literature on collaboration that defy this trend: the research on collaboration as a network (e.g. Wang, Rodan, Fruin, & Xu, 2014), on collaboration as knowledge integration (e.g. Bechky, 2003a), and on collaboration in virtual teams (e.g. Malhotra & Majchrzak, 2014a). This section elaborates on key insights from this literature and points to its limitations.
Firstly, researchers who study collaboration as a network have typically integrated the notion of proximity into their understandings about how collaborative networks form and evolve (e.g. Cassi & Plunket, 2013; Funk, 2014). Network researchers have explored the structure of “ties” between organisations, individuals, or knowledge resources, to understand the implications for organisational performance, innovation and other outcomes (Borgatti & Foster, 2003). Ties represent relationships, such as a friendship tie between two people, co-authorship on an academic paper, or a joint venture between two organisations (Brass, Galaskiewicz, Greve, & Tsai, 2004). The area of inquiry most relevant to my research is the role of proximity in the development of collaborative networks. Proximity, in the network perspective, has typically been conceptualised as the geographical distance between two organisations (e.g. Cassi & Plunket, 2013; Funk, 2014). Knoben and Oerlemans (2006) also point to six forms of non-spatial proximity, including institutional proximity and technological proximity, but these concepts that capture the similarity between organisations are not directly relevant to issues associated with the physical work environment.

In examining the implications of proximity for networks, researchers have focused particularly on the concept of “knowledge clusters”, where organisations from a single industry are collocated in a single geographic region (Asheim & Coenen, 2005). The most famous example is the high-technology cluster in the Silicon Valley (Yigitcanlar, Velibeyoglu, & Martinez-Fernandez, 2008). Although rarely subjected to empirical scrutiny, one of the main assumptions of research on knowledge clusters is that physical proximity between firms promotes knowledge spill-overs, because individuals who work for different organisations experience chance encounters in the local area, such as at events, community clubs, and children’s activities (e.g. Funk, 2014). These chance encounters can lead to knowledge sharing and opportunities for employees to take jobs at different firms, and may be the first step in the development of formal collaborations such as joint ventures or strategic alliances (Cassi & Plunket, 2013). Thus, a key assumption of the literature on network collaboration is that proximity fosters collaboration through facilitating chance encounters.

Network researchers have tended to conceptualise proximity in terms of the distance between organisations (e.g. Cassi & Plunket, 2013; Funk, 2014; Hallen, Katila, & Rosenberger, 2014). Few network researchers appear to have gone inside buildings to examine the implications of other physical variables, such as layout, barriers, or office size, on the development of collaborative networks. Similarly, there are few studies that have examined the interpersonal relationships that underpin ties between organisations (for an exception, see Arnaud & Mills, 2012). In terms of the literature on proximity and network
formation, there is an implicit assumption that people are self-organising and that informal networks will automatically emerge when people have opportunities to interact.

Yet, empirical research on network formation has suggested that the informal interactions facilitated by proximity may not always lead to collaboration. In their study of crowd innovation (collaborations that take place over the internet that rely on the participation of volunteers) for example, Franzoni and Sauermann (2014), found that managerial direction was imperative for ensuring that crowds produce useful solutions (see also Malhotra & Majchrzak, 2014b). This suggests that both informal and formal mechanisms are required to make collaboration effective. Furthermore, McEvily, Soda, and Tortoriello (2014) have outlined areas of overlap between formal workgroup networks and informal friendship networks, and argue for more research about the link between formal and informal structures in organisations.

Overall, the collaboration-as-a-network literature pinpoints two issues that could illuminate how new collaborative relationships develop in open-plan offices. Firstly, like open-plan office researchers, network researchers have focused on proximity as a key driver of personal encounters. Yet, scholars have rarely observed interpersonal interactions as they unfold. In response, I directly examine the impact of proximity on the development of new collaborative relationships. Secondly, network researchers have outlined the interplay between formal and informal structures as shaping collaboration. In contrast, researchers who study open-plan offices have tended to focus mainly on informal mechanisms, such as chance encounters and social norms. Through three empirical studies, I explore the role of both informal and formal structures in shaping collaboration in open-plan offices.

Alongside researchers who conceptualises collaboration as a network, researchers who have described collaboration in terms of knowledge integration have also pointed to some relevant issues for the physical work environment. The knowledge integration view of collaboration involves understanding how people with different types of expertise are able to combine their knowledge to solve a shared problem, such as designing a product (Elsbach & Flynn, 2013), understanding the evolution of cancerous cells (Bruns, 2013), or awarding a research grant (Hammedi, Van Riel, & Sasovova, 2013). The most relevant line of inquiry to my research relates to the role of boundary objects as facilitators of collaboration. A boundary object is a physical artefact that can be interpreted in multiple ways but which promotes the sharing of knowledge between groups (Carlile, 2002).

Scholars who study boundary objects have shown that collaboration is not just a social activity that involves verbal communication, but is situated in particular physical
contexts. Bechky (2003a), for example, has found that engineers with a conceptual understanding of a product, and assemblers with a spatial and temporal understanding of a product, struggle to communicate problems verbally, and can only understand one another when they can both see the physical product. Furthermore, Stigliani and Ravasi (2012) have found that product designers externalise their ideas by using post-it notes and pictures. The physical form of the objects allows team members to organise the objects in groups. This can help team members to “see” the connections between each other’s ideas and to ultimately come up with new product designs.

Although scholars who study knowledge integration have demonstrated the important roles of portable physical objects, such as designs (Bechky, 2003a), project plans (Yakura, 2002), and prototypes (Sutton & Hargadon, 1996) in facilitating collaboration, there has been little attention given to the physical contexts within which objects are stored and displayed. Yet the arrangement of physical objects can be just as important for facilitating collaboration as the objects themselves. Stigliani and Ravasi (2012), for example, have found that the way product designers arrange post-it notes on a wall is central to the process of integrating ideas, while Kirsh (1995) argues that layout of a production line can coordinate employee actions by spatially representing the order in which products must be assembled.

In terms of this dissertation, the literature on collaboration as knowledge integration provides two key insights. Firstly, the knowledge integration literature points to the central role of physical objects in facilitating collaboration. The focus of this literature, however, has been on the role of portable physical objects as scaffolds for collaboration, rather than on the broader physical work environment within which these objects are embedded. In this dissertation, I address this issue by examining the kinds of collaborative behaviours that are scaffolded by open-plan offices. Secondly, on a related point, organisations are increasingly adopting lean office spaces (e.g. Nieuwenhuis et al., 2014) and hot-desking practices (e.g. Hirst, 2011; Millward et al., 2007), that restrict the ability of employees to store, display, and retrieve potential boundary objects. Given the importance of these objects to collaboration, in this dissertation I explore how employees in open-plan offices use objects such as whiteboards, computer screens, and wall calendars to facilitate collaboration.

The final body of literature that relates to the physical aspects of collaboration is the research on virtual teams. Initially, a major concern of the literature on virtual teams was to explain differences between virtual and collocated teams (Martins, Gilson, & Maynard, 2004). In their review of the early research on virtual teams, Martins et al.(2004) note that virtual teams often take longer to make decisions than face-to-face teams, but are not clearly
inferior or superior to face-to-face teams in terms of performance. The rise of virtual teams has encouraged researchers to better understand what is distinctive about collocated teams and has drawn some attention to issues related to physical proximity (Foster, Abbey, Callow, Zu, & Wilbon, 2015). Over time, as more organisations have adopted virtual teams, researchers are now trying to understand why virtual collaboration is often so successful in spite of the vast physical distances that may exist between team members (Gilson, Maynard, Young, & Vartiainen, 2014).

In the context of this debate, Wilson, O’Leary, Metiu, and Jett (2008) argue that it is not physical proximity between people, but employees’ subjective feelings about the distance between people that shapes collaboration. By contrasting physical proximity with perceived proximity, they argue that individuals may feel emotionally close to people who are very far away (e.g. geographically distributed team), and emotionally distant from people who are physically close (e.g. accountants who share an office but have no reason to interact). In the context of virtual work, Wilson and colleagues contend that individuals’ perceptions of proximity are more important than physical proximity in fostering the communication and identification processes central to team work.

In their review of the proximity concept, Knoben and Oerlemans (2006) conclude that most researchers focus on non-spatial forms of proximity in seeking to explain interactions between individuals. Constructs such as cognitive proximity, social proximity, and technological proximity relate to how similar individuals are in terms of their perceptions, social networks, and experiences with tools, technologies, and equipment. Similarly, Dolfsma and van der Eijk (2015) point to the multi-dimensional nature of distance in terms of spatial distance, personal distance, organisational unit boundary distance, hierarchical distance and network distance. Although Knoben and Oerlemans (2006) argue that people who perceive themselves as similar are more likely to seek each other out and work together, the research on perceived proximity tends to conflate the concepts of social similarity with physical proximity. Yet Reagans (2011) demonstrates that social similarity and physical proximity have independent impacts on the strength of employee relationships.

Although the concept of perceived proximity helps to demonstrate that space has a subjective component, researchers focusing on employees’ perceptions of proximity underplay the objective constraints that physical distance can place on collaboration. Wilson et al. (2008) argue that people may collaborate at a physical distance because they feel close to one another, but do not explain how people who are physically close are able to avoid collaboration. Furthermore, the concept of perceived proximity does not address the idea that
physical environments are not open to endless interpretations, and that the physical form of work environments directs how people come to understand and use them (Gaver, 1996). As a result, individual perceptions do not completely explain the mixed empirical findings about open-plan offices and collaboration.

With regard to this dissertation, the literature on virtual teams provides two key insights. Firstly, individual perceptions shape employee responses to proximity, so it is important to account for individual cognition in examining the relationship between physical work environments and behaviour. In this dissertation, I respond to this issue by examining the role of individual schemas (mental models) in shaping employee responses to open-plan offices. Secondly, as Gilson et al. (2014: 1327) argue, researchers who study virtual teams have pointed to the need to better understand issues related to “mobility, space, place, location, and even workplace”. As technology enables employees to “work anywhere” (Bean & Hamilton, 2006; Kornberger & Clegg, 2004; Mazmanian, Orlikowski, & Yates, 2013) this raises questions about whether or not office space is relevant for team work. In this dissertation, I examine technology as part of the physical context of the open-plan office that shapes how teams collaborate.

Overall, the research on collaboration has provided three key insights into the relationship between physical work environments and collaboration. First, research from a network perspective highlights the importance of considering the formal and informal mechanisms that shape collaboration, including proximity. Second, research on knowledge integration demonstrates the role of portable physical objects (e.g. prototypes, designs and project plans) in facilitating collaboration. Third, the research on virtual teams suggests that employees’ proximity perceptions, and the changing technology environment, have implications for how teams collaborate. Yet, like the research on open-plan offices, the research on collaboration has tended to explore individual, social, and physical issues separately, and has not provided a view of collaboration as situated in particular physical and social contexts.

### 2.5 Conclusion

Given the limitations of the existing literature and the assumptions of situated cognition theory, in this dissertation I examine collaboration as a process that unfolds in social and physical context. Thus, Chapter 2 begins with a discussion of situated cognition theory. Based on this theory, I propose that collaboration arises from a combination of individual’s mental schemas (e.g. intentions, roles, rules), the social context (e.g. composition
and relationships between employees) and the physical context (e.g. open-plan offices, technology). I identify three different accounts of the relationship between open-plan offices and collaboration: a positive relationship, associated with the idea that open-plan offices are fun and creative environments; a negative relationship, associated with a cynical view of the open-plan office as undermining individual concentration and control; and a neutral relationship, associated with the ‘lean office’ and the idea that virtual collaboration is more efficient than face-to-face collaboration. The empirical evidence does not show clear support for any of these views (De Croon et al., 2005). I propose that a key reason for mixed empirical findings is that researchers have not simultaneously accounted for individual, social and physical factors when seeking to understand the relationship between open-plan offices and collaboration.

In the next chapter, I describe the research methods I used to examine the process of collaboration in open-plan offices. Study 1 is a case study of a collaborative science building that examines how people form new collaborative relationships in open-plan offices. Study 2 explores the conditions under which open-plan offices facilitate and inhibit collaboration through a comparative case study of eight open-plan offices. Finally, Study 3 is a comparative case study of seven teams in open-plan offices, and aims to show how teams use open-plan offices to collaborate. Overall the purpose of the three empirical papers is to examine the relationship between open-plan offices and collaboration in a way that captures individual schemas, physical context and social context.
CHAPTER 3: METHODOLOGY

3.1 Introduction

In this chapter, I justify the methodological approach of the dissertation by explaining its relationship to the research questions. I begin with an outline of how the critical realist paradigm (Bhaskar, 1998) is consistent with the situated cognition perspective (Elsbach et al., 2005; Semin & Smith, 2013), and point to the importance of considering both the objective physical world and the subjective mental and social worlds. The situated cognition perspective implies a commitment to focusing on individuals in their social and physical context, and a case-study approach is consistent with this commitment (e.g. Eisenhardt, 1989; Yin, 1994). I conclude the chapter with a justification of the data collection and sampling methods, and an overview of the steps I took to ensure the quality of the research. Overall, in this chapter, I explain why a case-study approach helps examine collaboration in its social and physical context.

3.2 Philosophical underpinnings and assumptions

The present research is underpinned by critical realism, which combines a functionalist ontology with an interpretivist epistemology (Bhaskar, 1998; Maxwell & Mittapalli, 2010). From a critical-realist perspective, there is a real world that is independent from individual perceptions, but our understandings of this world are social constructions that are fundamentally influenced by theory and our own perspective (Putnam, 1990). This is important for my research because I am not only interested in the objective world of the physical work environment and behaviour, but also the schemas (i.e. mental representations) that shape employees’ subjective experience. Whereas advocates of critical realism reject the idea of multiple realities, they assume that individuals may have different yet valid perspectives on reality (Maxwell & Mittapalli, 2010). Furthermore, individual perspectives are part of the world that social scientists seek to understand (Phillips, 1987). This means that objective physical and behavioural phenomena are just as important as subjective meanings and representations in explaining human action (Barad, 1996).

Edwards, O’Mahoney and Vincent (2014) suggest that the critical realist paradigm is a compromise between the extreme empirical approach of positivism and the extreme constructivist stance of interpretivism. In the social sciences, positivists seek to show that one or more variables (independent variables) lead to another variable (dependant variable) by
examining how often these variables co-occur (Zachariadis, Scott, & Barrett, 2013). In research on office space, for example, positivists have sought to understand whether independent variables, such as the size or height of barriers, can explain variance in particular dependant variables, such as the amount of time employees spend communicating (Boutellier et al., 2008; Hatch, 1987; Kim & de Dear, 2013). In contrast, critical realist researchers argue that a phenomenon (i.e. communication) cannot be understood outside of its social and physical context (Edwards et al., 2014). Thus, critical realists seek to understand the circumstances under which particular variables (e.g. high barriers), may or may not lead to particular outcomes (i.e. communication) by exploring the role of other variables (i.e. contexts) in shaping outcomes (Zachariadis et al., 2013). Furthermore, unlike positivists who try to isolate interactions between particular variables through laboratory experiments, critical realists are committed to the idea of an open social system and argue that phenomena must be understood in context (Edwards et al., 2014).

Unlike positivists who focus on measuring variables like emotions, attitudes, and behaviours, interpretivists suggest that we may only know reality through texts and discourses (Edwards et al., 2014). According to the interpretivist paradigm, knowledge is contingent, changing and constantly being renegotiated (Guba & Lincoln, 1994). Interpretivists are typically interested in identifying the particular categories that individuals use to make sense of the world (Gioia & Pitre, 1990). In terms of office-space, interpretivists have shown, for example, that employees understand and talk about office spaces in terms of instrumentality, aesthetics, and symbolism (Rafaeli & Vilnai-Yavetz, 2004; Vilnai-Yavetz et al., 2005). Although critical realists are also interested in understanding how individuals experience the world, they seek to go beyond the common-sense understandings that people construct for themselves (Edwards et al., 2014). Instead, the focus is on identifying deeper mechanisms that lead to observable phenomena (Zachariadis et al., 2013). Thus, in adopting a critical realist approach, I look for explanations that research participants cannot necessarily articulate: for example, how a combination of employees’ unconscious assumptions, spatial layouts and team structures may underpin observable phenomena (e.g. collaborative behaviours). Consistent with critical realism, the goal of this dissertation is to draw connections between the inner subjective worlds of participants and the external world of events and actions (Edwards et al., 2014).

Given the commitment of critical realists to studying subjective and objective phenomena in context (Edwards et al., 2014), the critical realist paradigm is compatible with the fundamental assumptions of situated cognition theory. Similar to advocates of situated
cognition theory (e.g. Semin & Smith, 2013), critical realists maintain that individual perceptions, social contexts and physical contexts are equally real and important explanations for behaviours. Critical realists seek to understand the mechanisms that underpin observed phenomena (e.g. collaboration), and seek possible explanations in both subjective (e.g. schemas, intentions, attitudes) and objective mechanisms (e.g. actions, interactions, walls, desks). Similarly, within situated cognition theory, behaviour emerges in specific situations that are defined by a combination of individuals’ schemas, the social context, and the physical context (Elsbach et al., 2005; Semin et al., 2012). By adopting a critical realist approach, I am able to extend existing research on open-plan offices by examining the interplay between individual characteristics (e.g. roles, stimulus screening ability), social processes (e.g. norms), and collaborative behaviours.

By focusing on collaborative behaviours as they unfold in open-plan offices, I challenge existing research on open-plan offices by exploring collaboration as a process, rather than an outcome. Tsoukas (2005) argues that researchers who study organisational processes typically take one of two ontological stances: the weak process view or the strong process view. Proponents of the weak process view assume that “entities” are real, and that processes involve “entities” changing to acquire new qualities (Langley, Smallman, Tsoukas, & Van De Ven, 2013). For example, in their study of collective sensemaking, Stigliani and Ravasi (2012) implied that “project groups” were entities that progress through four processes (noticing and bracketing, articulating, elaborating, and influence) in order to reach new shared understandings. Proponents of the strong process view (e.g. Tsoukas & Chia, 2002), assume that “processes” are real, and that “entities” are just analytical categories that capture processes at a point in time (Langley et al., 2013). For example, Gehman, Treviño and Garud (2012) argue that values are not entities, but are processes that are constantly produced though “values work”, which involves stakeholders dealing with pockets of concern, knotting local concerns into action networks, performing values practices and circulating values discourse.

Langley et al. (2013) suggests that advocates of the strong process view, typically focus on verbs rather than nouns (e.g. organising rather than organisations, collaborating rather than collaboration), and view outcomes as emergent, rather than as stable. Given the grounding of my research in critical realism, I take a weak process view to describe the entities (i.e. schemas and contexts) that shape how collaboration unfolds in open-plan offices. Thus, rather than exploring collaboration as an activity that is being constantly produced and reproduced through social interactions, I focus on how collaborative behaviours are enabled
and constrained by constellations of physical, social and individual factors (i.e. entities). Thus, my approach is consistent with a weak process view.

3.3 Justification of the case-study approach

Like many other researchers who locate their work in the critical realist paradigm (Edwards et al., 2014), I adopt a case study approach and qualitative methods to explore collaborative behaviours in context, and to look for subjective and objective mechanisms that might facilitate and inhibit collaborative behaviours in open-plan offices. A case study is an in-depth examination of a research phenomenon, in context, where the boundaries between the context and the phenomenon are not clear (Yin, 1994). In the case-study approach, the researcher does not seek to control variables but tries to understand a phenomenon in its natural setting (Eisenhardt & Graebner, 2007). Case studies are highly consistent with the assumptions of critical realism because they enable researchers to examine the mechanisms that underpin a phenomenon in context (Edwards et al., 2014). Within a case-study approach, critical realist researchers are free to adopt a variety of data collection methods, such as observations, interviews and surveys that can help them to identify the subjective meanings and attitudes, and objective structures and behaviours, that form the conditions which promote and inhibit particular outcomes context (Edwards et al., 2014). Thus, a case-study approach allows me to study collaboration in its physical and social context and thus answer my overarching research question: What is the relationship between open-plan offices and collaboration?

The case-study approach suits my research question, but there are three other reasons why a case-study approach has been adopted in this research. Firstly, few researchers have previously examined the relationship between the physical work environment and collaboration (see for exceptions Hua et al., 2010; McElroy & Morrow, 2010). Instead, researchers have focused on related behaviours, such as communication, interaction-satisfaction, and co-worker relations (refer to Chapter 2). In this regard, a case study can provide insights into phenomena in areas with little established literature (Eisenhardt & Graebner, 2007), and are often used as a starting point for defining a phenomenon, and understanding its relationships with other variables (Singleton & Straits, 2005). Given the aims of my research, a case-study approach is appropriate for exploring the relationship between the physical work environment and collaboration, in depth, and in context (Yin, 1994).
Secondly, one of the aims of this research is to untangle the mixed findings in research on open-plan offices, and to explain the conditions under which open-plan offices promote and inhibit collaboration. Case studies are ideal for generating new insights into an established phenomenon where it would be difficult to gather those insights through other approaches (Eisenhardt & Graebner, 2007). Unlike in experimental and survey-based designs, where the constructs of interest need to be tightly defined in advance, in a case-study approach, the researcher has some flexibility to examine surprising or interesting phenomena that emerge over the course of the research (e.g. Gersick, 1994). This makes it easier to challenge existing theory with the empirical findings (Eisenhardt & Graebner, 2007). Thus, a case-study approach allows me to develop new theory about the relationship between open-plan offices and collaboration, because I am able to remain sensitive to participants’ experiences of collaboration in these environments, and to follow up on unexpected findings that occurred during data collection (e.g. Alvesson & Kärreman, 2007; Hillson, 2015; Rennstam, 2012).

Finally, a case-study approach is consistent with a view of collaboration underpinned by situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013). Based on situated cognition theory, behaviour (e.g. collaboration) emerges from a combination of factors including (1) individual cognition (e.g. schemas), (2) social context (e.g. interactions between people), (3) and physical context (e.g. open-plan offices). While traditional approaches to cognition, such as schema theory, suggest that cognition should be studied under controlled laboratory conditions, advocates of situated cognition theory argue that cognition should be studied as it unfolds in natural settings. Researchers such as Hutchins (1995a) and Weick and Roberts (1993) have pioneered the study of cognition as an interactive group process that is best examined by observing groups of people carry out tasks such as navigating a ship or landing a plane (see also Cooke, 2015). The idea that collaboration is a situated process means that it is influenced by contextual factors, such as the perceptions of people in the group, communication between people in the group, navigation instruments, and information displays. A case-study approach is appropriate for this dissertation because it allows me to investigate the simultaneous influence of individual, physical and social mechanisms on collaboration in open-plan offices. Furthermore, consistent with a case-study approach, I am able to combine multiple methods of data collection (i.e. observations and interviews) to identify the subjective and objective mechanisms that shape collaborative behaviours in open-plan offices.
3.4 Justification of data collection methods

Consistent with Edwards et al.’s (2014) argument that critical realists should adopt research methods that best answer their research questions, case-study researchers typically combine different data collection methods (Eisenhardt, 1989) so that results can be triangulated (Jick, 1979). Thus, I use observation and interviews to explore the actual behaviour of employees and the accounts that employees make about their behaviour (see Sandberg & Pinnington, 2009). Archival data, such as organisational reports, diagrams of organisational structure, floor plans, and photos of the office space, are also gathered as background information, and to double-check factual claims made by participants during interviews and informal conversations.

Although some researchers who have conducted qualitative studies have directly observed how employees interact in open-plan offices (e.g. Ayoko & Härtel, 2003; Pepper, 2008; Värlander, 2012), most research is survey-based and quantitative (e.g. Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979; Sundstrom et al., 1980). Thus, scholars have been unable to observe how the process of collaboration unfolds in open-plan offices. Consistent with Silverman’s (2005) argument that quantitative research is most effective at identifying the links between inputs and outputs, researchers who have studied interaction and collaboration in open-plan offices have very rarely directly examined the phenomenon of collaboration. Instead researchers have examined inputs (e.g. barriers, density) and outputs (e.g. communication ease), and have theorised mechanisms via which inputs lead to outputs (e.g. chance encounters) without directly observing these mechanisms. In order to understand how inputs lead to outputs, especially in situations where the same input seems to sometimes promote and sometimes inhibit the same output, it is essential to directly study the phenomena through qualitative methods (Silverman, 2005). In terms of collaboration, this means moving the focus away from understanding how often or how much employees collaborate in open-plan offices, to qualitatively studying how collaboration unfolds in context.

Observation is an appropriate data collection method for capturing collaborative behaviour in its physical and social context. Hutchins (1995b) argues that cognition is situated and should be studied as it occurs “in the wild”, rather than in the laboratory. He suggests that observation is the best method to gain insight into the way that individuals communicate and manipulate the physical environment as part of their efforts to collaborate. Thus, during observation, I focused as much as possible on recording patterns of interaction.
among employees in their physical work environments. Field notes captured what participants were doing, where, and with whom. During observations I also engaged in informal conversations with participants to get their perspective on patterns of behaviour that I observed (e.g. whispering in the office). Consistent with Creswell and Miller’s (2010) notion of member-checking, during the later stages of data collection I spoke with participants about my emerging interpretations to see if these were consistent with participants’ understandings of their own thoughts and actions.

I used interviews to capture the internal mental representations of individuals and aspects of individual actions that were not apparent from the observations (see Sandberg & Pinnington, 2009). Consistent with other researchers who adopted situated cognition theory (Elsbach et al., 2005), I was interested in both the schemas (mental representations of knowledge) and contexts (e.g. physical, social environments) that shaped employees behaviour. The interviews provided insight into the schemas of participants, because they allowed participants to describe their assumptions and understandings in their own words (Kvale, 1996). Furthermore, the interviews provided insight into activities captured during the observation process (Sandberg & Pinnington, 2009). Interviewees were able to explain what they were doing from their own perspective (particularly when their task involved silently looking at a computer screen). Thus, the interviews captured variation in participants’ perspectives of the open-plan office and collaboration.

For this dissertation I collected two sets of observation and interview data that I present in the form of three studies (Study 1, 2 and 3). The first data set includes 245 hours of observations and 40 interviews from a collaborative science building. The collaborative science building is a single building that is occupied by 1000 employees from three government organisations. I refer to these organisations as Organisation 1, 2 and 3. The second data set includes 251 hours of observations and 33 interviews with employees from seven teams in three organisations. I refer to these organisations as Organisation 4, 5 and 6. I provide further information about the organisations that participated in my research in the next section where I describe and justify my sampling approach.

3.5 Justification of sampling

As one of the aims of this research was to understand why open-plan offices promote inconsistent outcomes, I adopted an emergent sampling design to respond to interesting or surprising themes that emerged during data collection (Alvesson & Kärreman, 2007; Gibbert & Ruigrok, 2010; Hillson, 2015). Thus, theorising was grounded in the actual experiences
and behaviours of employees in real open-plan offices, and incorporated the problems faced by employees in those offices (e.g. Fayard & Weeks, 2007; Rennstam, 2012). Putting aside existing conceptualisations of the open-plan office allowed me to examine the phenomena (i.e. the open-plan office) as it appeared to participants (Holt & Sandberg, 2011).

Consistent with the critical realist paradigm and case-study approach (Edwards et al., 2014), I did not start the research with a clear idea of the mechanisms that underpinned collaboration in open-plan offices. The investigation started broadly and involved observation of two open-plan offices in a single building (Study 1). I followed up on interesting findings by interviewing and observing employees in six other offices in the building (Study 2). The findings from Study 2 led me to focus on collaboration in teams, and involved sampling employees from three additional organisations (Study 3).

Given my emergent design, I will not explain how I devised and then executed a sampling design. Rather, I will follow Gibbert and Ruigrok’s (2010) recommendation to explain the sampling decisions made during the research process. Although the next section captures the key decisions and steps that led to the interpretation of the data presented in this dissertation, like much inductive qualitative research (see Eisenhardt & Graebner, 2007; Kaplan & Orlikowski, 2013; Vaujany & Vaast, 2014), the actual process of research involved many iterations, revisions, and dead-ends. Key steps in the sampling process are also presented in Figure 3.1.

3.5.1 Research context for Study 1 and 2

The organisations involved in Study 1 and 2 are three government organisations that occupy a single collaborative science building. Under the ethical clearance for the research, I am required to protect the identity of the organisations and the employees who participated in the research. Although I describe the organisations and the research site in as much detail as possible, I omit specific details that could be used to identify the organisations, site and participants.

Organisation 1 is a state government department with a focus on applied research that employs around 2000 people. They aim to provide leadership in the food, fibre, fishing and forestry industries in their state. The organisation is responsible for conducting applied research to improve agricultural productivity, managing and enforcing fisheries regulation, managing state-owned forestry areas and managing pests and diseases that pose a threat to agriculture.
Figure 3.1 Diagram of the sampling process
Organisation 2 is a state government department with a focus on scientific communication and legislative compliance that employed 3000 people. They aim to coordinate policy on science, innovation and technology across state government departments and to help consumers and businesses take advantage of emerging technologies. They are involved in science communication, managing the state archives, developing science policy, and providing support to other state government departments.

Organisation 3 is a federal government agency that conducts basic research and employs 6500 people. Their focus is on developing innovations that have a positive economic, social and environmental impact on Australia. They are involved in a broad range of scientific research in areas such as the environment, health, food production, information technology, mining and energy.

Employees from Organisations 1, 2 and 3 moved from 17 smaller sites into a single building to facilitate collaboration between scientists. The collaborative science building accommodated 1000 employees. Prior to the move, there were already some established collaborative partnerships and connections between employees from the three organisations, including formal agreements and projects. Informally, some scientists from Organisations 1, 2 and 3 also knew each other through professional networks, or because they had previously trained or worked together. By moving to the new building managers hoped to strengthen existing collaborations, promote new collaborations, and to share facilities and resources.

### 3.5.2 Sampling in Study 1

I gained access to the three organisations in the collaborative science building through a friend who worked in the building. In the first phase of my research I looked for an organisation that used open-plan offices where I might be able to make initial observations about the relationship between open-plan offices and employee behaviour. This is consistent with the aims of an inductive approach, whereby the researcher enters the field with a broad topic and remains open to discovering new insights (Alvesson & Kärreman, 2007; Rennstam, 2012). I began by asking friends or colleagues to put me in contact with gatekeepers at organisations that used open-plan offices. Eventually, I gained access to the collaborative science building through a friend, who was able to introduce me to the facilities manager of Organisation 1. I met with the facilities manager to explain my interest in the relationship between open-plan offices and employee behaviour. He agreed to support my research, so I entered into a formal agreement with Organisation 1. Under this agreement, I occupied a desk in the building while I conducted observations and interviews.

I had several discussions with the facilities managers about possible open-plan offices where I could conduct observations. The facilities manager suggested that there was a great difference in the amount of interaction in offices that were dominated by scientists and offices dominated by
administrative staff, and suggested that it would be good to observe in two offices to see the contrast. This was consistent with existing research that suggested task differences could impact employees’ responses to the open-plan office (e.g. Bridger & Brasher, 2011; Roper & Juneja, 2008; Venetjoki, Kaarlela-Tuomaala, Keskinen, & Hongisto, 2006). The facilities manager took me on a tour of four open-plan offices that accommodated groups from his organisation. I selected two offices based on the tasks being completed by the groups working in them: one office occupied by employees doing administrative tasks and one occupied by employees doing scientific research. The first office was occupied by employees from Organisation 1 and 2. The second office was occupied by employees from Organisation 1. I provide an example of a typical floor plan in the Collaborative Science Building in Appendix 2.

Consistent with an inductive approach, I developed the research questions for Study 1 (Chapter 4) during data collection. During my observations in the first office, I noticed that employees from Organisation 1 and 2 knew little about one another and rarely interacted, despite sitting metres apart. Employees used shared kitchen areas to meet with people from their own workgroups, rather than mixing with people from other organisations. These observations challenge the existing consensus in the literature that proximity between employees facilitates interaction (Allen & Gerstberger, 1973; Boutellier et al., 2008; Hatch, 1987).

To take advantage of this opportunity for developing theory, I modified my sampling strategy (see Alvesson & Kärreman, 2007; Gibbert & Ruigrok, 2010; Hillson, 2015). I extend the interview guide, and obtained permission to interview employees from the three organisations in the building. I selected interviewees to maximise variation (see Onwuegbuzie & Collins, 2007) in terms of organisation, workgroup, role, age and gender. In adopting this strategy, I intended to elicit the full range of perspectives about open-plan offices and the development of new collaborative relationships in the building.

During the interview process, I realised that some employees had reported developing new collaborative relationships in the building, while others had not. This moved the focus to individual differences and the examination of personal encounters between individuals in the building. A research question was developed in response to these issues, namely, RQ1: How do individuals develop new collaborative relationships in an open-plan office?

Once I had collected the data, I realised that the building was a critical case, with the potential to falsify or verify existing theory (Flyvbjerg, 2006), because it was a physical work environment that was supposedly “most-likely” to promote collaboration, and but where little collaboration was evident. As Flyvbjerg (2006) argues, it is often difficult to anticipate whether a research site might be a critical case until after data collection has begun. It was only when I noticed
that the collaborative science building seemed to have minimal impact on collaboration, that I realised that the building was a critical case.

The final interview data for this study included 40 interviews with scientists, science technicians, human relations officers, administrative staff, managers, and other professional staff from all three organisations in the building. The observation data for this study included 41 single-spaced typed pages of notes about (1), the shared spaces in the building and (2), interactions between people from different organisations in the building.

3.5.3 **Sampling in Study 2**

I collected the data for Study 2 (Chapter 5) at the same time as the data for Study 1, and in the same collaborative science building. To reiterate, the initial purpose of this study was to investigate a broad interest in the relationship between open-plan offices and employee behaviour. I started by making observations on two open-plan offices, one occupied by administrative staff and one occupied by scientific staff, with the intention of comparing employee behaviour from these two offices. Immediately apparent was that the administrative office was a noisy space with lots of interactions, whereas the science office was almost silent and interactions between employees were held in whispers. As a result, I refined my research to focus on collaborative behaviours and developed the following research question, RQ2: What are the conditions under which open-plan offices facilitate (and inhibit) collaboration?

I conducted interviews with employees from within the administration and science offices, and interviewed employees from six other open-plan offices in the building (a total of eight offices). A minimum of three employees were interviewed in each open-plan office, to capture similarities and differences within offices. Given that I had a formal agreement to make observations at the site for a six week period, I was unable to carry out formal observations of the interactions in all of the open-plan offices where employees were interviewed. The conditions of the ethical clearance for my research also limited the number of open-plan offices where I made observations. In the two open-plan offices that were the focus of my research I obtained written consent to record specific interactions between people in the office. Outside of these two offices, I informed everyone who worked in the building of my research through an email and provided employees with an option to opt out by emailing me. Although a number of employees responded to indicate interest in my research, nobody emailed me to opt out. As it was logistically impossible to obtain written consent from everyone in the building, I was unable to make detailed observations in other open-plan offices (i.e. recording what people were saying), but I did make some general observations about the noise levels and office layouts in other offices. Although this limited the extent to which I could compare the interview and observation data from six of the offices in my sample, I was able to get a
sense of the level of interaction between employees in all of the open-plan offices in my sample. Based on the sampling strategy, I decided to treat a group of people in an open-plan office as a case and to use a comparative case analysis approach (i.e. looking at the similarities and differences within and between groups in each open-plan office) (e.g. Dibble & Gibson, 2013; Eisenhardt, 1989; Graebner & Eisenhardt, 2004). Four of the cases were groups that worked in open-plan offices with little interaction and collaboration, and the other four cases were groups in open-plan offices with high levels of interaction and collaboration. This facilitated the comparison of cases to generate theory about the conditions under which open-plan offices facilitate and hinder collaboration (Yin, 1994).

The final interview data for this study included 39 interviews with employees from eight open-plan offices in the building. I used the same interview data as for Study 1, but omitted one interview with a facilities manager who oversaw the operations for the whole building. I choose to omit the interview with the facilities manager because the focus of the interview was about the operation of the building as a whole, rather than interactions in specific open-plan offices. I also used the same observation data as for Study 1. In Study 2 I focused on the observation data from within the open-plan offices, rather than the data collected in shared lunch areas and laboratory spaces. This included 153 pages of single-spaced, typed notes about interactions in the open-plan offices.

3.5.4 Research context for Study 3

One of the major findings from Study 1 and 2 was that the relationships between employees in an open-plan office shapes whether or not people used the open-plan office to collaborate. The employees who occupied the open-plan offices in the collaborative science building often had little formal reason to interact with one another. I was curious about whether employees who had formal reasons to interact would use open-plan offices to collaborate. Thus, in Study 3, I sought out three additional organisations to explore this question. I refer to the organisations that participated in Study 3 as Organisations 4, 5 and 6. I describe the organisations in as much detail as possible, but consistent with the ethical clearance for the research, I omit some details to protect the identity of the participating organisation, sites, and employees.

Organisation 4 is a leading Australian university that employs an equivalent of 6,800 full-time employees across 25 sites. The university has a focus on teaching and research and is ranked in the top 100 in the world according to the Time Higher Education World University Rankings. The university is attended by 37,000 undergraduate students and 13,800 post-graduate students. The University includes nine industry-funded, multidisciplinary research institutes that conduct research in areas such as climate science, social science, health science, and agricultural science. In 2013 the
University began producing Massive Open Online Courses, which are available for free online. The courses are on topics such as healthcare, psychology, philosophy and environmental science. One of the teams involved in this research came from a research institute and another came from a centre responsible for producing online courses.

Organisation 5 is a top-20 ASX-listed company responsible for producing commodities including coal, copper, iron ore, and petroleum, and employs 128,800 people in 26 countries. The company is involved with the discovery, acquisition, development and marketing of natural resources. The Australian operations of the company include underground and open-cut mines, processing plants, rail and port facilities, as well as global and regional headquarters. As a result, Organisation 5 has sites based in both metropolitan and regional locations in Australia. Both of the teams that participated in this research were engineering teams that worked in a regional office.

Organisation 6 is a top-20 ASX-listed company incorporating brands in the insurance, banking, and superannuation sector, and which employed 14,500 employees in Australia and New Zealand. The company has a strong focus on customer service, data analytics and innovation. The Australian operations of the company include corporate offices in five major cities, as well as 200 bank branches across the country. The three teams that participated in this research all worked for the part of the company that managed insurance and were based in an office located in a major Australian city.

3.5.5 Sampling in Study 3

In contrast to Studies 1 and 2, where the sampling strategy responded to unexpected findings and opportunities arising from the data collection process, Study 3 involved a multiple case-study approach and a pre-defined sampling strategy. In contrast to Studies 1 and 2, which were about the presence or absence of collaboration, the overall aim of Study 3 was to understand how open-plan offices shaped collaboration among people who had to collaborate. Thus, teams were selected as the unit of analysis because team members had to collaborate with one another, by definition. Given the adoption of situated cognition theory in Studies 1 and 2, I became interested in the role of physical objects (i.e. tools, technologies, and equipment) in facilitating collaboration (e.g. Bechky, 2003a; Carlile, 2002; Stigliani & Ravasi, 2012), and whether or not open-plan offices that limited the storage and display of physical objects (e.g. flex offices where employees do not have an assigned desk, open-plan offices with clean desk policies (see Bodin-Danielsson & Bodin, 2008; Hirst, 2011) had a negative impact on collaboration. Thus, I initially adopted a cell-sampling strategy (Robinson, 2013), which involved identifying three office conditions (high, medium, and low levels of personalisation) and selecting two or three teams in each condition for comparison.
I obtained access to Organisations 4, 5 and 6 through friends who were able to put me in contact with organisational gatekeepers. Each friend either worked for the organisation, had a spouse who worked for the organisation, or had a colleague who worked for the organisation. These contacts put me in contact with organisational gatekeepers. Gatekeepers were managers in the organisation who had the authority to provide me with access to research participants. For each organisation I negotiated with a gatekeeper about particular workgroups/teams that could participate in my research. Once I agreed on participating groups/teams with the gatekeeper, I communicated directly with participants without going through the gatekeeper, my friend, or any other initial contact at the organisation. I obtained written consent from all participants.

Based on Bodin and Bodin-Daniellson (2008), I sought to include small, medium and large open-plan offices in my sample, as well as open-plan offices were employees had assigned desks and open-plan offices where employees did not have assigned desks. Initially I sought similar teams across different types of open-plan offices, but found that organisations in different industries tended to adopt different kinds of open-plan offices. This meant that comparable teams tended to be located in similar, rather than different open-plan offices. In response to this problem, a maximum variation sampling strategy was adopted (Onwuegbuzie & Collins, 2007). Different teams in different types of open-plan offices, industries, and organisations were sampled to explore the range of ways that teams collaborated in open-plan offices. The diverse sample of teams, with different functions and from different industries, was beneficial because it allowed me to identify commonalities in the opportunities and challenges facing teams in open-plan offices. For example, all of the teams reported distractions and lack of privacy as relatively minor issues. This finding is in contrast to the existing literature on open-plan offices (e.g. Kaarlela-Tuomaala et al., 2009; Kim & de Dear, 2013; Roper & Juneja, 2008) and became an important part of the interpretation.

The final sample included two teams from the university (a Business Support Team providing administration support to academic researchers, and a Learning Improvement Team that developed online academic courses), two teams from the resource company (an Engineering Improvement Team responsible for improving engineering processes, and an Engineering Project Team responsible for making improvements to the supply chain), and three teams from the insurance company (a Business Improvement Team, responsible for improving business processes, a Business Compliance Team, responsible for internal audits, and a Customer Compliance Team, responsible for investigating customers’ insurance claims). I provide floor plans of the open-plan offices occupied by each team in Appendix 3.

The final interview data for this study comprised 33 interviews with employees from seven teams. The observation data for this study included 242 pages of single-spaced, typed notes about team interactions in open-plan offices.
3.6 Justifications of data analysis approach

The data analysis process was similar in Studies 1, 2 and 3 and involved inductive analysis to build theory from data (Eisenhardt & Graebner, 2007; Eisenhardt, 1989). Strauss and Corbin (1990) recommend three stages of coding: open, axial, and selective coding. During open-coding I read through interview transcripts and observational notes looking for statements which might answer the research questions (Strauss & Corbin, 1990). I then gave statements in the data labels that summarised their meaning and grouped together similar statements into first-order categories (Locke, 2001).

Axial coding involves looking for connections between the first-order categories, and grouping similar categories into tentative second-order themes (Strauss & Corbin, 1990). To assist with axial coding, I returned to the literature to investigate theoretical approaches that might illuminate the relationships between the themes (see also Fayard & Weeks, 2007; Rennstam, 2012). When coding the data for Studies 1 and 2, I wrote theoretical memos describing my results from a number of theoretical perspectives, by drawing on concepts such as the spatial triad (Lefebvre, 1991), the public realm (Loftland, 1998), and place attachment (Hidalgo & Hernández, 2001; Lewicka, 2011), before settling on situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013). Situated cognition theory helped me to analyse the data for Studies 1 and 2 by drawing my attention to the interaction between schemas, contexts, and (collaborative) behaviour (see for example Elsbach et al., 2005). When axial coding the data for Study 3, I also borrowed the concept of cognitive scaffolds from situated cognition theory (Clark, 1997), to conceptualise the open-plan office as a scaffold for collaborative behaviour (i.e. generating opportunities for collaboration, rather than causing behaviour). Thus, the process of axial coding involved making comparisons within the data (i.e. between open-codes), and comparing my findings to results and theories in the existing literature, to bring together similar open-codes into second order themes (Locke, 2001).

The final phase of the analysis involved selective coding, which is very similar to axial coding, but more abstract (Strauss & Corbin, 1990). I continued to compare and combine themes into higher order dimensions until a single encompassing theme emerged (Locke, 2001). In each study, the process of analysis was represented with a diagram to show how the first order categories were combined to form axial codes, how the axial codes were combined to form selective codes, and how this linked to an overarching statement that represented the data as a whole (see Kan & Parry, 2004).

Inductive data analysis is typically an iterative process that involves moving back and forth between open, axial, and selective coding, as well as between data and existing literature (e.g. Fayard & Weeks, 2007; Rennstam, 2012; Vaujany & Vaast, 2014). As a result, I revised open,
axial, and selective codes throughout the analysis process to better reflect my emerging understanding of the data. I used the qualitative analysis program, nVivo 10 (QSR International, 2014) to organise the data and to demonstrate relationships between statements in each category and theme (Hutchison, Johnston, & Breckon, 2010). I also kept an audit trail of coding notes explaining why categories were adopted, changed, or abandoned, and theoretical memos on emerging interpretations, and the meaning and dimensions of categories in relation to the existing literature (Strauss & Corbin, 1990).

3.7 Justifications of procedures for establishing research quality

Researchers who use qualitative methods typically adopt Lincoln and Guba’s (1985) conceptualisation of rigour as credibility, dependability, transferability, and confirmability. I now summarise the research quality criteria and the steps I took to meet them (see Table 3.1). As researchers choose to address these strategies in varied ways, I draw on Gibbert and Ruigrok’s (2010) best-practice recommendations for the reporting of rigour in case-study research. Gibbert and Ruigrok (2010) argue that in reporting case-studies, researchers should, (1) explain concrete research actions, justifying decisions and trade-offs, (2) prioritise internal- over external-rigour, and (3) explain how data collection strategies changed over the course of the research, including opportunities that arose during the research.

<table>
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<tr>
<th>Criteria</th>
<th>Definition</th>
<th>Procedures used in Chapters 4, 5 and 6</th>
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<tbody>
<tr>
<td>Credibility</td>
<td>Findings reflect participants’ understandings</td>
<td>• Triangulation of observation and interviews</td>
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<td>• Review of interpretations by supervisors</td>
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<td>Dependability</td>
<td>The logic leading from data to interpretation is made explicit</td>
<td>• Constant comparison</td>
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<td>• Comprehensive use of data</td>
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<td>• Deviant case analysis</td>
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<td>• Pattern matching</td>
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<td>Transferability</td>
<td>The contexts in which the findings are likely to hold is clear</td>
<td>• Explain rationale for case study selection</td>
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<td>• Selection of multiple cases (multiple case studies or embedded units)</td>
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<td>• Outline case study context</td>
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<td>Confirmability</td>
<td>The researcher reflects on their role in the research process</td>
<td>• Case study protocol</td>
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3.7.1 **Credibility**

The concept of credibility concerns whether or not the researcher has accurately captured and represented the phenomena that they claim to be studying, and involves interpreting the data in a way that accurately reflects the understandings of participants (Lincoln & Guba, 1985). In my research, the main strategy for ensuring credibility was the use of multiple data collection techniques (Creswell & Miller, 2010; Yin, 1994). Consistent with the critical realist paradigm, I was interested in capturing participants’ understandings of collaboration, as well as the mechanisms that shape collaboration that participants may not be aware of or are unable to articulate (Edwards et al., 2014). Thus, in each study, observations and interviews were combined to examine how collaboration takes place in physical work environments.

A second strategy involved using my supervisors as reviewers (Gibbert & Ruigrok, 2010). I performed the majority of data collection and analysis. My primary supervisor, who is an expert on physical work environments and teams, reviewed the results of Studies 1, 2 and 3 several times. I worked closely with my primary supervisor to revise my results until I had established a clear chain of evidence for my interpretation of the data. My secondary advisor, whose expertise is outside of the specific area addressed in my dissertation, was more removed from the analysis process. He reviewed the results from an outsider’s perspective and provided comments about whether or not the link from data to results was logical, well-supported, and communicated effectively.

3.7.2 **Dependability**

Dependability concerns whether or not the data support the reported interpretation results of the study (Lincoln & Guba, 1985). Researchers need to ensure they do not select only findings that support their existing views, but that the results reflect the data as a whole (Silverman, 2005). In each study, I addressed dependability by making constant comparisons between cases (individuals, groups, and teams) and attempting to determine the factors that led to differences and similarities between them (Eisenhardt, 1989; Strauss & Corbin, 1990). Throughout the analyses, I looked for cases that were not explained by my emerging hunches, and tried to reconcile these cases by looking for alternative explanations (Alvesson & Kärreman, 2007). I continued to modify my interpretation until the whole data set was explained (Locke, 2001).

Secondly, pattern matching was employed during data analysis (Yin, 1994). I iterated between the data and existing literature until I found a theoretical lens that illuminated the relationship between the physical work environment and collaboration (Eisenhardt, 1989). As described in the previous section, I wrote theoretical memos (Charmaz, 2006), exploring the links between my data through several theoretical lenses before settling on situated cognition theory.
(Elsbach et al., 2005) as an overarching framework. To ensure dependability, I also provided an explanation of how my findings relate to existing literature in the discussion sections of Studies 1, 2 and 3. The discussion sections describe how the research findings support, challenge, and extend existing literature.

3.7.3 Transferability

Transferability is achieved by informing the reader about the contexts in which the research findings are likely to apply or not apply (Lincoln & Guba, 1985). In Study 1, I relied on the logic of analytic generalisation to establish the transferability of my findings. Analytical generalisation involves making links between particular observations and broader constructs or theories (Polit & Beck, 2010). Observations in a collaborative science building were used to make claims about the relationship between open-plan offices and collaboration. I drew on situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013), to show how specific physical settings, attitudes, and behaviours can be generalised into broader statements about the link between open-plan offices and collaboration. In Studies 2 and 3, I established transferability through case-to-case transfer. Case-to-case transfer involves the application of findings from one group or setting to another group or setting (Polit & Beck, 2010). This involved selecting multiple cases, to check if the findings apply across contexts and to check the boundary conditions of my findings (Eisenhardt, 1989; Yin, 1994). Transferability was strengthened by providing a detailed description of the research context in Studies 1, 2 and 3, and by highlighting the limitations and strengths of each study.

3.7.4 Confirmability

The confirmability of a case study is the extent to which another researcher could look at the same evidence and come to similar conclusions (Lincoln & Guba, 1985). A research protocol was prepared to outline the steps taken during the data collection and analysis process (Gibbert & Ruigrok, 2010). As suggested by Gibbert and Ruigruck (2010), I explained instances in which data collection did not go to plan, including how I creatively used setbacks to strengthen the quality of the research. Rather than presenting a “neat” methods section, implying that the research was carried out exactly as planned, in Studies 1, 2 and 3 I explained the concrete steps taken to complete the research with the resources that were available. The research process was documented carefully so that decisions made during data collection and analysis were as transparent as possible.
3.8 Conclusion

In this chapter, I justify the critical realist paradigm as a lens that guides the assumptions of this research. I also demonstrate that a case-study design is appropriate for studying collaboration as it unfolds in context. Furthermore, I show that the combination of observation and interview collection techniques allowed me to gain insight into what people do (behaviour) as well as what people think (schemas), which is consistent with the critical realist paradigm and with situated cognition theory. I also justify my sampling and data analysis procedures. I conclude the chapter with an outline of the steps taken to ensure that the research is credible, dependable, transferable, and confirmable.

The following three chapters present three empirical studies. In Chapter 4 (Study 1), I examine the development of new collaborative relationships, and draw on the concept of intentional serendipity to challenge the idea that physical work environments generate collaboration through spontaneous encounters. In Chapter 5 (Study 2), I use the same data set as Study 1 to explore why people in similar open-plan offices engage in different levels of collaborative behaviour. In Chapter 6 (Study 3), I discuss the findings from a second study on team collaboration in open-plan offices. I conclude with a discussion chapter that integrates the three studies and explains the contributions of the dissertation to theory and practice.
CHAPTER 4 (PAPER 1): SERENDIPITY AS THE LINK BETWEEN OPEN-PLAN OFFICES AND COLLABORATION

4.1 Link to previous chapters

In Chapter 2, I argue that studying collaboration as a process, rather than as an outcome, is a step towards untangling the mixed findings in research about collaboration in open-plan offices. In Chapter 3, I establish the role of a case-study approach in exploring how collaboration unfolds in its physical and social context. Study 1 takes up these issues by exploring the mechanisms via which collaboration unfolds in open-plan offices. I explore this through a case study of a collaborative science building. At the time of data collection, the building contained 20 open-plan offices and was occupied by 1000 employees from three different government organisations. The building was intended to promote inter-organisational collaboration, and thus provided an appropriate setting to explore the mechanisms via which employees develop new collaborative relationships in open-plan offices. Study 1 is presented in the form of a paper with its own research problem, methods, results and discussion sections.

4.2 Introduction

One thousand scientists and support staff from three different government organisations and seventeen different worksites had moved into a single collaborative science building that was designed by architects to promote cross-organisational interaction, collaboration, and innovation. Consistent with the assumptions of existing research (e.g. Boutellier et al., 2008; Davis et al., 2011; McCoy & Evans, 2002; Monge et al., 1985; Peponis et al., 2007), the building was supposed to promote collaboration by channelling employee movements into central spaces, such as shared kitchen areas, open-plan offices, and laboratory facilities, where there were opportunities for scientists from different organisations to engage in chance encounters.

Yet, two years after moving into the collaborative science building, very few scientists had formed new collaborative relationships and many were cynical about the very idea that spontaneous encounters might promote collaboration. To further complicate matters, a minority of scientists had developed new collaborative relationships that they suggested did stem from spontaneous encounters in the building. In this Chapter, I present a qualitative case study that investigates two

2 An earlier version of this paper was presented at the 16th Conference of Asia-Pacific Researchers in Organisation Studies in Sydney, Australia.
broader problems about the relationship between open-plan offices and collaboration in the context of a collaborative science building. First, I examine the assumption that chance encounters are the link between physical work environments and collaboration. Second, I examine why a physical work environment might facilitate collaboration for some individuals and not for others.

Open-plan offices are rooms that are occupied by more than four people (but typically with room for fifty or more people) where there are few barriers and where workstations are arranged in groups (Bodin-Danielsson & Bodin, 2008). The relationship between open-plan offices and collaboration is complicated, with existing research suggesting that there is no clear relationship between open-plan offices and collaborative behaviours such as interaction, communication, and cooperation (e.g. De Croon et al., 2005). The academic debate has focused on whether more open or more private physical environments are more conducive to fostering informal collaboration (e.g. Allen & Gerstberger, 1973; Hatch, 1987; Oldham & Brass, 1979; Sundstrom, Herbert, et al., 1982), or whether elements of both proximity and privacy are required to facilitate spontaneous encounters (Fayard & Weeks, 2007).

To contribute to these debates, I choose to focus on informal collaboration, and adopt Kreiner and Schultz’s (1993) definition of informal collaboration as involving three stages: (1) personal encounters leading to the discovery of collaborative opportunities, (2) exploration of the feasibility of shared ideas and, (3) the crystallisation of collaborative relations, including an increase in knowledge sharing and recognition of the collaboration by others. I focus particularly on personal encounters, because my early observations suggested that one of the major stumbling blocks to collaboration at the collaborative science building was the dearth of personal encounters between scientists from different organisations.

I shift the focus of the debate away from the physical features of an environment that are supposed to promote collaboration, to examine the processes that promote personal encounters in the context of a physical work environment designed to facilitate collaboration. I reconceptualise personal encounters as a form of situated cognition (Elshach et al., 2005) that involves elements of both intention and chance. Situated cognitions are actions that emerge from the interaction between individual intentions and a physical context, and include the idea that individuals tend to respond to physical environments in a way that is consistent with their goals (Semin & Smith, 2013). For example, research participants who were asked to read a story about walking through a house, were more attentive to a leaky roof when they were told that they were potential home buyers, and were more likely to recall the expensive television when told they were robbers (Pichert & Anderson, 1977). This implies that individuals who view collaboration as congruent with their intentions may be more likely to perceive opportunities to collaborate in their environment, compared to individuals who are not interested in collaboration.
My view of collaboration is that it arises from the interaction between individual intentions and the physical work environment. This is pertinent because it highlights both the physical features of the environment and the perspectives of the individuals using the space. Although researchers have argued that social norms can explain why similar physical work environments (e.g. open-plan offices) may facilitate collaboration in some studies and not in others (Fayard & Weeks, 2007; Pepper, 2008), little attention has been paid to explaining differences between individuals from the same workgroup, organisation, or building. Thus, we know little about why individuals who are subject to the same social norms might respond differently to the same physical work environment, and in particular, why some individuals may experience spontaneous encounters and why others may not.

It is important to understand the relationship between physical work environments, individual intentions, and personal encounters, because organisations are increasingly adopting physical work environments such as open-plan offices (Brager, Heerwagen, Buaman, & Huizenga, 2000; Chan, Beckman, & Lawrence, 2007; Elsbach & Bechky, 2007) or co-locating different organisations at the same site (Moodysson & Jonsson, 2007; Tallman, Jenkins, Henry, & Pinch, 2004; Yigitcanlar et al., 2008) to facilitate new collaborations across workgroup and organisational boundaries. Yet, most researchers who study open-plan offices make comparisons between workgroups in different offices (e.g. Hatch, 1987), or conduct research in a context where established workgroups move from one office to another (e.g. Brennan et al., 2002; Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979). Although employees with established relationships are likely to feel obligations to interact when they encounter each other in an office (Fayard & Weeks, 2007), Hirst (2011) found that unacquainted employees who shared a flex office (an office where employees do not have an allocated desk and sit next to new people each day) ignore each other because they do not see opportunities to develop ongoing relationships. Thus, there may not be a simple relationship between proximity and collaboration, especially among employees who do not already know one another.

To extend the boundaries of theory about open-plan offices, collaboration, and situated cognition, I set out to answer the following research question: How do employees develop new collaborative relationships in open-plan offices? This research question allows me to develop theory about personal encounters in physical work environments, while also providing managers with guidance on how to align employee intentions and the physical work environment to promote collaboration. I build on Fayard and Weeks’s (2007) argument that physical work environments create opportunities for interaction (rather than cause interaction), by showing why some individuals take up opportunities for interaction that are made possible by their physical work environment, and why other individuals avoid these opportunities. Next I describe the context,
sample, and methods for a case study on personal encounters in a collaborative science building. I then discuss my findings in terms of the research questions, including their implications for theory, practice, and future research.

4.3 Methods

As I seek to challenge the assumption that chance encounters are the link between physical work environments and collaboration, I took an inductive approach in which I observed people interacting in a physical work environment that was supposed to facilitate collaboration. As Eisenhardt and Graebner (2007) have argued, inductive case study designs are highly appropriate for challenging existing conceptualisations of a research phenomenon, because they allow the researcher to capture individual behaviours, and the meanings that individuals ascribe to their behaviours, as they unfold in context. Adopting the case study approach, I collected data through observation and semi-structured interviews. Observation was appropriate because I was interested in understanding the relationship between the physical work environment and collaboration, rather than presenting an insider’s view of how employees experienced the building.

Consistent with Alvesson and Karreman’s (2007) suggestion that a researcher’s focus should evolve as he or she encounters surprising or counter-intuitive phenomena, I developed a research problem during the data collection process. Alvesson and Karreman (2007) argue that surprises constitute a “breakdown”, whereby the researcher’s understanding of events is incongruent with their knowledge of existing theory and literature. These authors suggest that the researcher may frame a breakdown as a “mystery”, in the event that it cannot easily be explained by examining more empirical material or through reading more literature.

I therefore entered the field with a broad interest in understanding how open-plan offices impact on the ways that employees do their jobs. Because my initial interest was broad, the specific research questions and themes did not arise until late in the research process. Given that the building was designed to enhance collaboration between people from different organisations, I became intrigued as to why these people rarely interacted with each other. In general, the employees from different organisations knew very little about one another, even when they sat side-by-side in open-plan offices. In the shared interaction areas, people ate lunch in their work groups rather than interacting with people from the other organisations. At building-wide social events and seminars, employees rarely interacted with others outside of their own organisation. Overall, there seemed to be very little inter-organisational collaboration going on in the collaborative building.

My observations seemed to counter a substantial body of research that indicates a strong relationship between physical proximity and interaction (e.g. Borgatti & Cross, 2003; Reagans, 2011) and was not easily explained by gathering further empirical material. This led me to focus my
research on understanding why scientists in the building were not collaborating across organisational boundaries. To untangle this mystery, I will first describe the research site, before detailing data collection, analysis methods, and then outlining my results.

4.3.1 Research setting and participants

The collaborative science building was located in an Australian city. It was constructed to bring together employees from three different government organisations so that they could pool resources, share laboratory space and equipment, and minimise the replication of projects. This involved consolidating personnel from 17 different office buildings and research stations into a single building with the capacity to seat 1000 employees. According to a brochure released by one of the organisations occupying the building, the building was “designed to stimulate closer working relationships between researchers from different organisations and scientific disciplines, encouraging new scientific discoveries and technologies”.

The interior of the building incorporates large, enclosed spaces and glass walls to create a feeling of openness, and to maintain visual connections between the three wings of the building. From the ground floor, it is possible to look up and see the kitchen areas that join the wings on the four levels of the building. The kitchen areas incorporate long, stainless steel benches, with two sinks, a column of microwaves, a row of silver refrigerators and a number of different-sized wooden and plastic tables. The kitchen areas open out onto two open-plan offices on the ground floor and six open-plan offices on levels one, two, and three. The open-plan offices were different sizes and contained desk space for between 20 and 90 people each. Twelve of the open-plan offices were adjacent to laboratory facilities.

The building was occupied by three government organisations that I refer to as Organisation 1, Organisation 2, and Organisation 3. The first organisation had a focus on applied research and employed around 2000 people. The second organisation had a focus on scientific communication and legislative compliance and employed 3000 people, and the third organisation had a focus on basic research and employed 6500 people. A number of science groups from each of these organisations were located at the building. Employees worked in a variety of roles, and included scientists, science technicians, science engagement officers, managers, human relations officers, occupational health and safety offices, and administrative officers.

I had a number of things in common with the people in the open-plan offices at the collaborative science building that allowed me to quickly develop rapport. I could relate to employees in administrative roles because I had previously worked for the government and had an understanding of the policies and procedures that employees had to follow, as well as the political climate in which people were working. At the time of this research, there had recently been a
change of government, a restructuring of government organisations, and a large number of redundancies, which many employees were very angry about. I could also relate to employees in scientistic and technical roles because my parents had careers in the sciences. I was familiar with the kind of small research stations that many scientists had occupied before moving to the Collaborative Science Building. Thus, I felt empathy for the scientists who expressed nostalgia about the sense of community in their old research stations and who suggested that they resented being forced to move to the new building. Finally, as a PhD student (albeit in the social sciences), I connected with other PhD students working in the collaborative science building, who were also experiencing the process of learning to do research, of preparing research proposals, managing supervisor relationships and collecting data. I was able to have interesting conversations about the process of research in the social and biological sciences, including different approaches to sampling and theorising. This familiarity meant that people in the collaborative science building quickly felt comfortable with me and included me in social conversations, morning teas, Christmas parties and social club events.

I also had distance from people in the building, in that I did not work for the same organisation as participants, and had no direct experience with the kind of work that they conducted (human relations management, science communication, administration, management, scientific research). I managed any preconceived ideas that I had about participant’s experiences of open-plan offices by selecting participants with a wide range of perspectives. I also explored my data through a range of different theoretical lenses before coming to my final interpretation.

4.3.2 Data collection

The data collection began in two of the building’s open-plan offices, with a general focus on how the open-plan offices influenced the ways in which people performed their jobs. For the first three weeks I observed an office occupied by administrative staff and managers from Organisations 1 and 2, and for the second three weeks I observed an office of scientists and science technicians from Organisation 1. These offices were chosen because they were occupied by employees doing very different kinds of work (routine verses complex), and existing research suggests that task-type has a large influence on employee experiences of open-plan offices (e.g. Beaman, 2005; Block & Stokes, 1989). During the six weeks of observations, I spent between four to five days a week and seven to nine hours per day at the building. I occupied a desk alongside other employees in a work group within each of these open-plan offices, and recorded observation notes directly onto a laptop. I produced 187 pages of single-spaced field notes that captured interactions between employees in open-plan offices, meeting rooms, interaction areas, coffee areas, and the building’s café. A
surprising observation was the rarity of interactions between employees from different organisations.

Intrigued by the lack of collaboration in a collaborative building, I began to focus more on the interactions between people from different organisations. I expanded my focus beyond the open-plan offices occupied by Organisation 1 to examine the shared parts of the building, and to seek interviewees from Organisations 2 and 3. I was able to obtain permission to conduct interviews with employees from Organisations 2 and 3, and to make informal observations of the open-plan offices they occupied (i.e. I visited these offices and made general notes about my impressions, but did not make detailed notes about specific interactions). I recruited interviewees through a snowball sampling design, whereby I asked my initial interviewees to introduce me to other employees. I sought to maximise variation by asking my contacts in Organisation 1 to refer me to employees who worked in different roles, different open-plan offices, and different organisations within the building. Initially, few contacts could introduce me to potential interviewees from other organisations or work groups, which provided further evidence that there were few relationships that spanned group boundaries. When I eventually found employees who had formed connections with people from the other organisations, I became curious as to why some employees had developed new collaborative relationships, and others had not.

For the interview phase of the study, I conducted face-to-face interviews with 40 employees who worked for the three organisations in the building. Interviews were semi-structured and were based around 10 core questions. As these questions provided only a guide, I was free to follow up on interesting comments and themes that arose during the interviews. This allowed each interviewee to present their individual perspective and to cover issues that were important to them in more detail. Interview questions included, “How does the open-plan office help you to do your job?”, “How does the open-plan office make your job more difficult?”, and “What has your experience been working in the building as a whole?” The interview guide appears in the appendix to this dissertation. All interviews took place in meeting rooms or private offices in the building, except for one that took place at another building where an employee had been relocated. On average, each interview lasted 38 minutes, with the shortest being 13 minutes and the longest, 62 minutes. Each interview was audio-recorded and transcribed verbatim. Transcriptions had an average length of 10 single-spaced pages and totalled 420 pages (214,803 words) for all 40 interviews.

4.3.3 Data analysis

I analysed the data in three phases (Refer to Figure 4.1). In the first phase I focused on barriers to and facilitators of collaboration in the building. I uploaded the interview transcripts and observation notes to the qualitative analysis program, NVivo 10 (QSR International, 2012).
Drawing on the guidelines supplied by Strauss and Corbin (1990), I followed the process of open-coding. This involved reading through each document and assigning sections of text with labels that summarised their meaning for me. These labels were created as I read through the text. Statements relating to similar concepts were coded with the same open-code. At this stage of the analysis, open-codes were about the barriers to and facilitators of interactions between employees from different organisations (e.g. different policies, priorities and approaches, shared spaces, previous relationships). I focused on understanding the differences between characteristics of employees who had and who had not developed new collaborative relationships with others in the building (e.g. social orientation, career stage, formal role, intentions).

During the second phase of analysis, I grouped open-codes together through the process of axial coding (Strauss & Corbin, 1990). This involved making constant comparisons between open-codes and searching for similarities and differences between them (Locke, 2001). I generated higher order “axial codes” that summarised groups of open-codes. During the process of axial coding, I returned to the literature to help make sense of how the open-codes related to one another. I found that the situated cognition perspective (Elsbach et al., 2005; Semin & Smith, 2013) foregrounded the role of individual intentions in shaping how individuals respond to their social and physical environment. Adopting this perspective helped me to draw links between the individual differences that shaped individual views of collaboration as being the result of either intention or chance. I also organised the open-codes relating to context (e.g. functionality, transition) into axial codes, depending on whether they related to the social, organisational, or physical context.
The third stage of analysis involved selective coding (Strauss & Corbin, 1990). At this stage I realised that the collaborative opportunities described by participants involved both an element of spontaneity, in that they were unexpected, but also an element of intention, in that individuals made efforts to interact with others by looking for common ground, making introductions, and attending events at the building. I identified *serendipity* as the core phenomenon and began to relate other categories to this phenomenon. The final step involved identifying that individuals in the building faced a range of barriers to collaboration, and even those who intended to collaborate with others in the building needed to overcome these barriers. I present the outcomes of my analysis in the next section.

4.4 Results

This study was motivated by the lack of attention on the development of new collaborative relationships in open-plan offices. Thus, the results section addresses Research Question 1: How do employees develop new collaborative relationships in open-plan offices? First, I show how the
social, physical and organisational context of the collaborative science building made it difficult for individuals to develop new collaborative relationships in the open-plan offices. Then I discuss individuals’ different schemas, which shaped how they responded to the social, physical and organisational context. The final part of this section describes how context and schemas come together to shape personal encounters in open-plan offices. Overall, these results explain why co-locating employees in an open-plan office will not necessarily lead to the development of new collaborative relationships.

4.4.1 Physical, social and organisational context

Although the collaborative science building generated opportunities for employees to experience personal encounters with new people, the observation notes and interviews suggest that these encounters were rare. Despite sitting alongside one another in shared, open-plan offices, scientists from different organisations rarely interacted. To begin to untangle this puzzle, I show how elements of the physical, social and organisational context created barriers for scientists to experience encounters with people outside of their own organisation. Based on my data, and consistent with situated cognition theory, context is one element that shapes collaborative behaviour. The next section describes the physical, social, and organisational context of the building, and outlines the relationship between context and personal encounters.

Physical context and personal encounters: the physical context of the collaborative science building included the open-plan offices, laboratory spaces and interaction areas that were shared by employees from the three different organisations in the building. The architect’s website and two articles published in architecture journals also stated that the building was designed to allow scientists from different organisations to work together by creating a “building without walls”. The building incorporated open-plan offices and lab spaces that were shared between employees from different organisations, and included common interaction areas to enhance chance encounters. The architect’s website proclaims that laboratory spaces were situated at either end of the building so as not to impede interactions between employees in the open-plan office areas. Based on observation notes, employees from different organisations regularly moved through shared spaces such as open-plan offices, interaction areas, stairwells and lifts, and had many opportunities to experience personal encounters with people from other organisations. Yet, few employees took up opportunities to interact with new people.

Although the building provided spaces where employees could have personal encounters with others from different organisations, there were also some physical features that inhibited interaction. Employees regularly complained that the interaction areas echoed and were uncomfortable. The use of glass and hard furnishings, together with the openness of the building,
meant that noises from events held in the ground floor’s seminar room resonated throughout the whole area. This made the interaction areas noisy and busy. As a result, the spaces lacked the intimacy that many employees suggested might be more conducive to promoting interactions with new people. Furthermore, in the interviews, employees suggested that the small tables provided in the interaction areas facilitated segregation into smaller groups. A science technician explained why her group had stuck together rather than mixing with people from other organisations:

The people from [another site] were already here, so at lunch time they were sitting on those tables. It’s funny, we thought, “ah we’ll go somewhere else”, not, “oh we’ll join these people” (laughs) … we had already formed our social bonds and you know, we needed an area to keep everyone together then we needed a, you know, big area. We just couldn’t join other people because there wasn’t enough space. [Science Technician, Organisation 1, I8]

Overall, the observation notes and interviews suggest that many employees were not attracted to the shared spaces in the building, and tended to avoid these spaces. This meant that there were few opportunities for scientists to interact during their day-to-day work and in the context of formal events.

Social context and personal encounters: Alongside physical context, the social context made personal encounters between employees from different organisations less likely. The social context of the building included the people in the building and the established relationships between them. Many employees in the building retained strong emotional attachments to the sites that they had moved from and to the people from those sites. In the interviews, employees expressed resentment at being moved from their old sites. In an informal conversation about the move to the new building, two employees explained:

SZ said, “Don’t think that we all aren’t angry about being moved! Some of us just deal with it better!” … DN responds, “we were like family, would you say?” SZ replies, “It was not just that but that it was nice opening the window, hearing the birds and the gardener in the morning”. [Observation Notes, O8]

Based on the observation notes, employees continued to tell stories and jokes about their old sites, perpetuate traditions that started at the old sites, and wear t-shirts and use coffee mugs associated with the old sites. Furthermore, in the interviews, many employees suggested that they were not convinced inter-organisational collaboration was a good idea, and explained that they did not see any need to form new relationships in the building. Thus, employees’ attachments to their old sites manifested as social barriers to interaction in the building, because employees focused on maintaining existing relationships, rather than meeting new people.

The clearest evidence of social boundaries in the building lay in the shared interaction areas, where employees sat with people from their own work group or old site. One scientist observed, “We have morning tea for 10 minutes [before] 10:30 and if we haven’t gotten up and left by 10:30,
there’s people milling around from some other group that are waiting to sit on our table” [Scientist, Organisation 1, I31]. It was not particularly common for groups to join one another or share a table. Instead, employees would politely wait until the table was free and then sit down with their regular group. Based on observation notes, employees typically had morning tea at a regular time and table with people from their old research site. For example:

As usual, I went down for morning tea at 10.30am. I followed DI and RS down the stairs to the group’s usual table on Level 1. DI mention indignantly, half joking, “There are people at our end of the table!” We sat down the other end of the table away from the other group [Observation Notes, O13]

Observation notes suggest that employees from different organisations rarely interacted in the kitchen areas. In support of this observation, a scientist mentioned in an interview that he would be perceived “a little bit like a traitor” if he sat down with another group [Scientist, Organisation 1, I16]. Thus, scientists experienced social pressure to avoid interacting with new people outside of their own work group.

Furthermore, employees who tried to initiate interactions with people from other organisations suggested that this was a difficult process. A science communication officer, for example, described his unsuccessful attempts to join in with another group,

There wasn’t that openness there to sort of – I mean, there wasn’t rudeness, but it just – their conversations tended to be about what they knew and they’d talk to their own people that you’d feel out on a limb, so you obviously socially don’t feel like continuing sitting there and not feeling included. [Science Communication Officer, Organisation 2, I23]

Through subtly excluding others, employees reinforced the social boundaries between groups and made interactions between groups more difficult. Thus, the social context created barriers for people from different organisations to engage in personal encounters in open-plan offices and shared spaces.

Organisational context and personal encounters: As well as the physical and social context, the organisational context also shaped personal encounters in the building. The organisational context included the policies and goals associated with each organisation. In the interviews, participants spoke about incompatibilities between the organisations. For example, a manager suggested, “There’s three different agencies all wanting different things, so it’s very hard to manage.” [Manager, Organisation 1, I17]. In particular, the three organisations struggled to reconcile policies that prohibited people from outside their own organisation accessing spaces and equipment. A human relations officer from Organisation 2 suggested “when [Organisation 3] started they didn’t want any of the departments to be able to come through their access doors” [Human Relations Officer, Organisation 2, I25].
An example of policy shaping interactions in the building related to the boat storage area, which was shared by marine scientists from Organisations 1 and 3. A scientist explained that neither Organisation 1 nor Organisation 3 were allowed to provide access keys to people from outside their own organisation. He described the problem:

Whenever anyone was going to the [Organisation 1] boat area, they’d be going into the [Organisation 3] boat area. And because it was a [Organisation 3] key, they decided to change it to a [Organisation 1] key, which meant that we suddenly went down there to get our boats out one morning and we couldn’t get our boats out … We couldn’t give them an [Organisation 3] key, they couldn’t give us an [Organisation 1] key. I mean, we finally got it resolved. We finally got the areas unlinked and a fence put between them so we could actually have a secure area that we were keyed to. [Scientist, Organisation 3, I27]

The boat storage incident not only shows that the three organisations had policies that made it difficult to work together, but also that organisations were unwilling to change their policies to overcome these issues. Instead of sharing facilities, the organisations ended up creating separate spaces. This reduced the likelihood that employees from different organisations would experience chance encounters, and meant that the interactions they did have involved competing for, rather than sharing, limited work space.

A second aspect of the organisational context was that the different organisations had different purposes and goals. Organisation 1 was involved in applied research, Organisation 2 focused on policy and compliance, and Organisation 3 conducted pure research. An Occupational Health and Safety Officer from Organisation 3 argued that scientists who worked for Organisation 2 were “not reading journal papers and trying to do cutting edge science, they’re just doing monitoring programs, which is important, but it’s not cutting edge stuff” [Occupational Health and Safety Officer, Organisation 3, I30]. These very different types of science manifested in different organisational cultures. A scientist, who had previously worked for Organisation 3 but was working for Organisation 1 at the time of this research, argued that, “[Organisation 3] is highly competitive, it’s very exclusive… while [Organisation 1], they are very – they are really inclusive… they are more social.” [Scientist, Organisation 1, I16].

Overall, the differences between organisations meant that few scientists had obvious reasons to collaborate with people from other organisations in the building. A manager compared the potential for collaboration in the building to previous attempts in her organisation to promote the sharing of spaces and resources between different groups:

They brought the two science areas together saying … “There’s savings to be made. You guys can share cars, you can share people”. Well no we can’t, because the science we’re doing is very different, but we do it at the same time, in different spots (laughs)… I think there is probably some of that that goes on between the groups here too. [Manager, Organisation 2, I9]
Overall, the incompatibilities between organisational policies and goals limited the opportunities for genuine collaboration between scientists from different organisations. Yet despite the considerable organisational, physical and social barriers that limited opportunities for chance encounters in the building, there were some scientists who had experienced chance encounters that had developed into ongoing collaborative relationships. In the next section, I present results that show that scientists’ individual characteristics shaped their intentions to collaborate with others in the building, and impacted on their likelihood of experiencing personal encounters.

4.4.2 Individual characteristics and intentions

Despite the barriers to chance encounters created by the physical, social and organisational context of the building, the interviews suggest that some employees did experience chance encounters in the building and that some of these encounters lead to ongoing collaborative relationships. Based on observation and interview data, and consistent with situated cognition theory, I found it was not just context that shaped employee behaviour, but the interaction between context and individual intentions. In this study, I identified three individual characteristics that shaped employee intentions to collaborate. Individuals who identified as sociable, who were early career researchers, and who worked in a formal job role that required them to collaborate with others in the building, were more likely to desire meeting new collaborators in the building, and to report that they experienced personal encounters with potential collaborators. These findings are elaborated in the next section.

Social orientation and intentions to collaborate: The first individual characteristic that shaped employees’ intentions to collaborate was their social orientation. The theme social orientation captures the idea that people vary on the extent to which they enjoy socialising and meeting new people. Based on the interviews and observations, scientists who liked meeting new people typically sought out interactions with people outside of their own organisation. For example, in an informal conversation, a scientist from Organisation 3 explained that he preferred the collaborative building to the isolation of his old site. Observation notes show that the scientist had become friends with some employees from Organisation 1, and had socialised with them in the shared kitchen area, at an Organisation 1 Christmas Party, and at a building-wide social club event. One day, the scientist’s work group was gathered at the end of a long wooden table in one of the shared kitchen areas. A group from Organisation 1 came to sit down at the far end of the table, leaving a gap between themselves and the group from Organisation 3. On this occasion, the scientist was the only group member from Organisation 3 who greeted and chatted with the scientists from Organisation 1. Otherwise the employees from the two organisations shared the table without
engaging with one another. Thus, employees who enjoyed meeting new people tended to seek out and take up opportunities to interact with employees outside of their own organisation.

Although some scientists suggested they liked meeting new people, participants also argued that many scientists were either introverted or shy and would not feel comfortable interacting with strangers in the building without a specific reason. In an interview, one scientist suggested, “I’m pretty much an introvert and I’m less comfortable with just sitting down and talking socially over lunch with people I don’t know very well” [Scientist, Organisation 1, I33]. Furthermore, scientists who identified as social often contrasted themselves to the majority of scientists who they claimed were introverted, for example:

I’m quite an outgoing person and I will tend to talk to anyone, but for a lot of our scientists, they’re quite introverted. Some of them are quite extremely introverted, so the idea that they would just sit down and strike up a conversation with someone is not – it’s just not going to happen. [Scientist, Organisation 3, I37].

Overall, an individual’s social orientation shaped whether or not they were open to meeting new people in the building. Scientists who enjoyed socialising tended to express positive views about the potential for meeting new collaborators in the building, while scientists who were less social tended to suggest they would be unlikely to introduce themselves to someone they did not know. Thus, an employee’s social orientation shaped their intention to seek out collaborators in the building.

Career stage and intentions to collaborate: Alongside employees who enjoyed socialising, early-career researchers were another group of employees who suggested that they were motivated to meet people outside of their own organisation. The theme career stage captures the idea that PhD students and junior scientists had greater incentives to build new collaborative relationships than scientists who were already established researchers or who were anticipating their retirement. Early-career scientists tended to suggest that other scientists in the building had expertise that was interesting or relevant to their own research. In one interview, a PhD student argued that she valued working with other scientists in the building because “their knowledge and their expertise and the conversations you have with them are worth a lot” [Scientist, Organisation 1, I38].

Furthermore, the observation notes suggest that there was a group of PhD students, junior scientists, and science technicians from different work groups and organisations in the building who occasionally socialised at lunch and at building-wide social club events. A PhD student who was part of this group explained that he knew scientists from different organisations in the building because he had gone to university with them, or had been introduced to them through someone in his own work group. Based on observation notes, this PhD student regularly socialised with a core group of people from Organisation 1, but occasionally interacted with other young scientists from Organisations 2 and 3.
Conversely, senior scientists tended to socialise exclusively with others from their own work group, or with collaborators who were based outside of the building. Senior scientists expressed the most negative opinions about the potential for the building to influence collaboration. They often argued that they chose collaborators based on expertise, not on who was nearby. One scientist, for example, explained, “the guy I bounce most ideas off is in Hobart, and the other support people are over in Western Australia and in New Zealand” [Scientist, Organisation 3, I27]. Another senior scientist described how he found his collaborators: “It wasn’t that I bumped into them having coffee at some, you know, venue… you know them already or you meet them at a meeting of mutual interests, like a conference or a workshop or someone recommends them to you” [Scientist, Organisation 1, I32]. Senior scientists who were not interested in forming new collaborative relationships tended not to experience or take up opportunities to engage in personal encounters with new people in the building. Unlike early-career researchers, who expressed positive opinions about the potential to find new collaborators in the building, senior scientists tended to suggest that they had an established network of collaborators and were not looking for new people to work with.

**Formal role and intentions to collaborate:** Finally, scientists who had formal work roles that required them to develop collaborative relationships with people from other organisations tended to suggest that they were open to meeting new people in the building. The theme of *formal role* captures the idea that some scientists who worked in communication or management roles were compelled to work with people in other organisations in the building, and were more likely to suggest that they actively sought to develop new collaborative relationships. For example, in their interviews, science communication officers expressed very positive opinions about the impact of the building on their ability to meet and work with scientists from outside of their own organisation. One science communication officer suggested:

> I do have a lot more connections but that possibly has a lot more to do with the fact that it’s part of my role as well. It’s something I look out for and I also am conscious of listening to what other people sort of say that they’re doing and maybe putting people in touch with each other and going “Oh, you’re working on that. Well, I’ve heard somebody else is working on that and it may be a good idea to contact them” [Science Communication Officer, Organisation 2, I20]

During the interviews, the four science communication officers explained that part of their job was to build connections between people in the building. As a result, they sought out and took up opportunities to meet new people in the building.

The observation notes also suggest that many of the interactions between people from different organisations included employees working in facilities management or operation management roles. For example, the operations manager for the building suggested that, “the design of these spaces out here means that people do mix because you can’t help but chat to people at the
kitchen sink” [Manager, Organisation 2, I1]. Employees whose roles required them to work with people from other organisations tended to notice and seek out opportunities to develop relationships with people from other organisations in the building: for example, by introducing themselves to others in the building, making connections between scientists who were working in complementary areas, or by engaging in informal interactions to build relationships.

Conversely, employees without a mandate to pursue inter-organisational collaboration suggested they were less likely to seek out interactions with people from other organisations, and experienced few opportunities to collaborate. For example, a manager suggested, “I work with the people that I need to work with… I wouldn’t want to be putting myself out there and say ‘Hey, this is the sort of work we do, look at the partnerships etc.’, because we wouldn’t be able to follow through” [Manager, Organisation 1, I18]. Unless employees were in a formal role that required them to work with people from other organisations, they often had no reason to form new collaborative relationships.

In summary, three individual characteristics shaped scientists’ intentions to collaborate with others in the building: social orientation, career stage and formal role. A comparison of scientists, based on the interview data, demonstrates the reasons why these individual characteristics were associated with the intention to collaborate (refer to Table 4.1). For example, scientists who were in the early stages of their careers intended to collaborate with new people in the building, because they thought that meeting new people would allow them to develop their professional network and access expertise. Alternatively, scientists who were moving towards the end of their career were not interested in collaborating with others in the building, because they had established collaborators already, and did not necessarily view the people in the building as experts in their specialised field. Scientists who were either socially oriented, in the early stages of their career, or in a role that required inter-organisational collaboration, generally suggested that they were open to collaborating with others in the building. Those scientists who had intentions to collaborate also tended to experience personal encounters in the building, and had developed new relationships with people outside of their own organisation.

4.4.3 The serendipitous encounter

Although the scientists who participated in this research generally described collaboration as either spontaneous or purposeful, on careful analysis of the data I found that almost all of the personal encounters described by participants involved elements of both intention and chance. A science communication officer summarised this idea in his comment that, “[The building] is good from my perspective because I can interact with a lot of people, and say hello and find out what you
do, but if you’re not inclined that way, the structure of the building doesn’t necessarily help you to do that” [Science Communication Officer, Organisation 2, I23]. Consistent with this comment, the interview and observation data suggests that open-plan offices shape collaboration by generating opportunities for chance encounters, but only when individuals seek out, or at least remain open to, interacting with others in their office or building. Thus, personal encounters in open-plan offices involve an element of intention (e.g. someone seeking to meet new people) and an element of chance (e.g. two strangers with similar interests encountering one another in an elevator).

<table>
<thead>
<tr>
<th>Individual characteristic</th>
<th>Intention to collaborate with others in the building</th>
<th>No intention to collaborate with others in the building</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social orientation</td>
<td>Scientists who suggest that they enjoy meeting new people in the building. <strong>Interviewees:</strong> I7, I8, I16, I23, I24, I36, I37</td>
<td>Scientists who suggest they do not want to, or do not feel comfortable with, approaching people they do not know in the building. <strong>Interviewees:</strong> I6, I31, I32, I33, I35</td>
</tr>
<tr>
<td>Career stage</td>
<td>Scientists who suggest that meeting new people in the building allows them to develop professional networks and to access experts. <strong>Interviewees:</strong> I7, I13, I14, I15 I16, I38</td>
<td>Scientists who suggest they have an established network of collaborators and work with experts wherever they are located. <strong>Interviewees:</strong> I6, I19, I27, I34, I40</td>
</tr>
<tr>
<td>Formal role</td>
<td>Scientists who suggest their job requires them to meet new people in the building. <strong>Interviewees:</strong> I20, I22, I23, I24</td>
<td>Scientists who suggest their job does not require them to meet new people in the building. <strong>Interviewees:</strong> I2, I6, I27</td>
</tr>
</tbody>
</table>

Given the importance of intention and chance in shaping personal encounters, this research shows that personal encounters are best characterised a serendipitous. Dew defines serendipity as, “search, leading to unintended discovery” (Dew, 2009). In terms of situated cognition theory, the physical, social and organisational context of a collaborative building can create opportunities for (or barriers to) personal encounters, but individuals are only likely to notice and take up opportunities to meet new people if this is consistent with their intentions. Consistent with the notion of serendipity, the observation data shows that individuals experienced personal encounters with new people when they sought out or remained open to interactions with others in their building, for example, by displaying open body language (e.g. eye contact, smiling), by engaging others in interactions (e.g. saying hello, asking questions), or by going to a part of the workspace where and when they anticipated opportunities for interaction (e.g. kitchen, seminar room, social club event). Conversely, individuals avoided personal encounters when they made purposeful efforts to avoid others, for example, by displaying closed body language (e.g. avoiding eye contact, walking swiftly), avoiding conversations or cutting them short, and by going to spaces where they anticipated opportunities for solitude (e.g. at their desk, in a vacant meeting room).
As a way of defining serendipitous encounters, I contrast them to purposeful encounters. Purposeful encounters involve intentionally seeking out someone for the purposes of working with them on a shared project. Many scientists in the building reported engaging in collaborations that arose out of purposeful encounters, such as working with existing colleagues, being invited to work on a funded project, or seeking out people with particular expertise. Unlike purposeful encounters, serendipitous encounters did not stem from an initial intention to collaborate. For example, a scientist from Organisation 1 described a serendipitous encounter that occurred between her colleague and a person from Organisation 2:

[My colleague] actually ran into a guy in the lift and was talking to him about random stuff, and they said “Hey, we’ve got a high performance computing” and then he told us, because he knows that’s the kind of stuff we do, and so we ended up contacting them [Scientist, Organisation 1, I15]

This encounter had an element of chance: it was possible only because both people worked in the building, and stepped into the lift at the same time. Yet, the encounter also involved intention, because the scientist from Organisation 1 had to initiate a conversation, ask about common interests, and then inform his existing colleagues about the interaction. In the next section, I explore the idea that serendipitous encounters simultaneously involve intentions and chance by outlining three types of serendipitous encounters that occurred in the building.

**Discovery of a common interest or problem:** The first type of serendipitous encounter involves two or more people discovering that they have a common interest or problem. In the interviews, scientists who collaborated with others in the building typically described an encounter where they discovered they shared a research interest with someone else. These encounters usually occurred because a scientist had taken the initiative to introduce themselves to someone new, or to ask someone a question about their area of expertise. A science communication officer provided an example:

Well, one example is there’s a [scientist] from [Organisation 3] that’s working on a project which he calls “Pathways to Impact”… He’s coming actually to give a presentation to a group of us to give us an update on the project and some of that work will then form the way that we do science engagement. It really is just – and it came from those chance conversations, having that – us being prepared to be social and saying “Are you new here?” or whatever and introducing ourselves. [Science Communication Officer, Organisation 2, I23]

Based on informal discussions and interviews, serendipitous encounters sometimes arose out of the perception of a common problem. For example, when two of the organisations at the building both experienced a large number of redundancies, people who had previously avoided talking to one another began to join each other’s conversations to share information about the changes.
In terms of the observations, common interests created opportunities for people who did not usually interact to come together. An example of this occurred when the air force purchased some new planes and arranged a flyover to show the public. People from the building who were interested went up to the roof of the building to watch:

AN asks me if I want to see the plane fly over, so I tag along with a group of employees from my office. We walk across to the other wing to catch the service elevator up to the roof to watch the planes fly over. People from other offices race up and jump in as well. We are all laughing and making jokes as the elevator goes up. Someone asks if anyone has access to the roof. AN says, “yes, me”. Everyone laughs. People get on at the next level before we arrive at the roof. There are about 20 people on the roof to watch the planes fly over [O4].

The common interest in watching the plane (or in taking a break from work) created a context for people from different offices and organisations to come together in the same place. Discovering this common interest was somewhat intentional, because people had to make the effort to go up to the roof, but also involved chance, because people were able to have unplanned interactions with others in the lift and on the roof.

Conversely, scientists who suggested that they had little in common with others in the building told me they tended to avoid opportunities to engage with new people. Instead they reported experiencing serendipitous encounters at conferences or workshops where they perceived they had common interests with the other attendees. For example, a scientist suggested:

I don’t need interactions! I get all the interaction [when] I go to conferences. I read papers, and that’s where I get my inspiration from. Sometimes when we have a meeting, but that is not in the immediate work environment. I do not get that here. I get that when I go somewhere else, when I go to meetings and learn new things. That’s where I get inspiration, but not here, because this group, the people I’m surrounded [by] here are all from my group and then there’s others that work on something totally different, where, it’s not even related to me. [Scientist, Organisation 1, I6].

Unlike in this example, other scientists used chance encounters with new people as an opportunity to identify common interests. These opportunities occurred by chance, because they involved unplanned interactions, but were also intentional because scientists chose to engage in those interactions and used them to identify or discuss common interests and problems.

*Encountering existing colleagues:* A second form of serendipitous encounter involves a scientist encountering colleagues that they know from a previous workplace. The interviews show that scientists who suggested the building had a positive influence on collaboration often mentioned encountering existing colleagues in the building. Thus, the building made it easier for scientists to reunite with existing colleagues and participate in ongoing or new collaborations with them. For example, a science communications officer suggested, “I have met colleagues from [Organisation 3]
and other areas [who] I [hadn’t] seen for years until I bump into them at morning tea and outside” [Science Communications Officer, Organisation 2, I22].

Collaborative opportunities would also emerge sometimes when scientists introduced their old colleagues to their new colleagues. Typically, scientists who were cynical about the potential of the building to improve collaboration implied that collaboration was contingent upon strangers meeting each other in the hallway. Yet, I observed that encounters between people who had never before met occurred when scientists introduced their existing colleagues to new people. For example, one day when employees from Organisation 1 were having morning tea in the shared kitchen area,

A scientist from Organisation 1 approaches the table and asks if she can introduce her colleague. She explains that he is on a contract to do a specific piece of work. The scientist goes around the table and introduces everyone, explaining their roles in administration and management. They chat for a little while. [O5]

In this situation the scientist took the opportunity to introduce someone she already knew to other people in the building. This encounter was intentional, because the scientist took the opportunity to make the introduction, but also spontaneous, because it occurred as she was walking past the table in the kitchen area.

In the interviews, scientists who had found new collaborators also described how opportunities for collaboration arose when they encountered people they had previously worked with and introduced them to their current colleagues. For example, a scientist described the role of mutual colleagues in facilitating collaboration in the building:

A couple of weeks ago I was [looking for some equipment]… And so I asked one of the admin people in [Organisation 1] now, who is in this building, and she said “Oh yeah, I know somebody who’s – and I think the instrument is in the [Building]” so I got onto that person with the instrument, just as a result of almost randomly talking to somebody, sitting down with a coffee out there [Scientist, Organisation 1, I13].

These chance interactions with mutual colleagues were serendipitous because they were spontaneous, and often occurred in the shared interaction areas in the building. Yet these interactions were also intentional because colleagues had to take up opportunities to interact with and introduce one another.

**Attending events:** Finally, serendipitous encounters would sometimes occur when scientists attended events or workshops in the building. In the interviews, scientists who had found new collaborators in the building argued that events, such as fundraising morning teas, science week displays, and social club events, provided scientists from different organisations with opportunities to interact. This pattern was also evident at a social club function:
IN, from Organisation 3, invited me to after-work social drinks in the kitchen area on level 1 of the building. Initially, there were mostly people from Organisations 3, including MK, who I had met before. Later, some of the younger scientists from Organisation 1 showed up including DM and LS from Office 4, and MR, LS, and DP from Office 2. The scientists from Organisation 1 stuck together at first. They all seemed to know MK from Organisation 3, but not many of the other Organisation 3 people. I introduced LS from Organisation 1 to IN from Organisation 2, and they started chatting. [Observation Notes, O29]

The social club event generated opportunities for scientists to engage in unplanned interactions with new people, but this only happened if someone initiated those interactions. Scientists first had to make the effort to attend social club events and then engage in interactions with people outside of their own organisation. These interactions were spontaneous because they could occur with anyone who had attended the event, but were also intentional because scientists had to take up opportunities to engage with people from outside of their own organisation.

Alongside social club events, scientists who had found new collaborators in the building suggested that seminars were a great way to find out about other people’s expertise and provided a context for people to get to know one another. Based on the interviews, employees tended to attend their own colleagues’ seminars, and avoid seminars where people from other organisations were presenting. A Science Technician suggested that this tendency could be harnessed to improve collaboration in the building:

The best thing has been the seminar series because that brings out… they have had a few topics that have say, an animal science person and a plant person. So all the plant people come to hear the plant person and the animal people go to hear the animal person and then there’s a little bit of interaction, so over time I think that would help. [Science Technician, Organisation 1, I8]

These comments point to the intentional aspect of personal encounters that take place at events. Opportunities for collaboration were intentional because scientists had to make the decision to attend and engage with others at these events, but were also serendipitous because by attending events, scientists had opportunities to meet people that they did not expect to meet.

In summary, purely chance encounters between strangers in open-plan offices are rare, and most encounters are better characterised as serendipitous. Serendipitous encounters contain elements of both chance and intention.

4.4.4 Outcomes of serendipitous encounters

Very few of the serendipitous encounters that I recorded in my observation notes, and that the interviewees described, actually lead to the development of new collaborative relationships. Kreiner and Schultz (1993) describe personal encounters as the first stage of informal collaboration, and suggest that personal encounters facilitate the discovery of collaborative opportunities. They
suggest that for new collaborative relations to crystallise, potential collaborators also need to explore the feasibility of shared ideas, and then engage in ongoing knowledge sharing. Thus, although serendipitous encounters have the potential to facilitate the development of new collaborative relationships, this is likely to be a rare occurrence. At least in terms of the serendipitous encounters I recorded, it was more common for encounters to lead to the development of new professional or social relationships. In Table 4.2, I provide some examples of different types of serendipitous encounters, the circumstances that shaped each encounter, and the outcomes of each encounter.

The interviews reveal one instance where serendipitous encounters in the collaborative science building led to the development of an ongoing collaborative relationship: The scientists from Organisation 1 and 2 who met in the lift, discovered a shared interest in high performance computing, and then began regularly working together. There was also one example of an encounter in the building that led individuals to discuss the feasibility of shared ideas and which had the potential to develop into a new collaborative relationship: The science communication officer from Organisation 2 who met a scientist from Organisation 3, and had arranged for him to talk about his project on research impact with the rest of the science communication team. Although this relationship could not be characterised as a new collaborative relationship, there was the potential that it might develop into one over time.

More commonly, the serendipitous encounters I recorded led to the development of new professional relationships or new social relationships. Professional relationships involve collegiality, helping and mentoring, but are not necessarily collaborative because they do not involve ongoing and intensive knowledge sharing. A number of serendipitous encounters that I observed in the building led to the development of new professional relationships. For example, a morning tea organised to celebrate a scientist’s birthday provided an informal setting where scientists who were visiting from another building were able to chat with scientists from the building, and extend their professional network. In terms of social relationships, in the interviews, participants provided examples of serendipitous encounters that had enabled employees in the building to develop new friendships. For example, a manager from Organisation 1 described how events, such as charity barbeques and shared sports activities, had allowed employees from different organisations to meet one another and form social relationships.
Attending events

<table>
<thead>
<tr>
<th>Type of serendipitous encounter</th>
<th>Examples from interviews and observations</th>
<th>Context</th>
<th>Chance</th>
<th>Intention</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discovering a common interest or problem</td>
<td>[I] It looked like the fourth floor of this building there were a lot of people working with computers… [T] This night I took the lift and there was this guy coming back from the fourth floor that looked friendly so I just started to talk about whether he came from this area… We started to talk about computers and we have this interest in common and slowly, slowly we get to know each other and they help us to do our work. (Scientist, Organisation 1, I16)</td>
<td>The physical context of the lift created an opportunity for people from different organisations identify common interests.</td>
<td>Two people with an interest in high-performance computing had an unplanned encounter in the lift.</td>
<td>The scientists had to talk to one another about the computers to realize they had a common interest.</td>
<td>New collaborative relationship</td>
</tr>
<tr>
<td>Encountering mutual colleagues</td>
<td>Well, one example is there’s a [scientist] from [Organisation 3] that’s working on a project which he calls “Pathways to Impact”… He’s coming actually to give a presentation to a group of us to give us an update on the project and some of that work will then form the way that we do science engagement. It really is just – and it came from those chance conversations, having that – us being prepared to be social and saying “Are you new here?” or whatever and introducing ourselves. (Science Communication Officer, Organisation 2, I23)</td>
<td>The physical context of the open-plan office created an opportunity for people from different organisations identify common interests.</td>
<td>Two people with an interest in science engagement had an unplanned encounter in the open-plan office.</td>
<td>The science communication officer had to introduce himself to someone new in the office.</td>
<td>Explore feasibility of shared ideas</td>
</tr>
<tr>
<td>Attending events</td>
<td>I have met new people, but mostly through social things. So we tend to eat lunch together with – down on the next floor – with the soil people. So through them we’ve met other people. And the same with [Organisation 1]. Like once you bump into one person, then they introduce you to other people. (Science communication officer, Organisation 2, I22)</td>
<td>The physical context of the building enabled employees from different to move through the same spaces.</td>
<td>The interactions involve unplanned encounters in the shared interaction areas in the building.</td>
<td>Employees had to take the initiative to introduce mutual colleagues to each other when an encounter occurs.</td>
<td>New social relationship</td>
</tr>
<tr>
<td></td>
<td>I am walking around the foyer and see a group of six people out in the courtyard, including DM and LS from the animal science group, who I have met before. I smile at DM and he pats the bench beside him to signal to sit down. I go and join them. Everyone introduced themselves by saying his or her name. They all work in animal science except for AS, who works in plants and MC who is a statistician (Observation notes, O7)</td>
<td>The social context of a lunch break created a reason for people to pass through the courtyard at the same time.</td>
<td>The interaction involved an unplanned encounter in the shared courtyard in the building.</td>
<td>Employees had to take the initiative to introduce mutual colleagues to each other when the encounter occurred.</td>
<td>New professional relationship</td>
</tr>
<tr>
<td></td>
<td>That’s what I organised this year, a pink ribbon breakfast, and that’s across the agencies. We just had to set the barbeques up and had it out in the atrium and everyone came and a couple of the girls from [ORG2] helped organise it and they were awesome at getting donations from businesses and stuff… They went into, there’s a big dragon boat race. I think you have twenty oarsmen or whatever you call them in the team and we put in a cross-agency- so there were people from ORG3, ORG2 and ORG1 all in the team. (Manager, Organisation 2, I1)</td>
<td>The social context of charity and sporting events enabled people from different organisations to interact.</td>
<td>Employees are able to have unplanned interactions with others at events.</td>
<td>Employees had to take the initiative to attend events.</td>
<td>New social relationship</td>
</tr>
<tr>
<td></td>
<td>DS organized a morning tea to celebrate his birthday. Most of the people from the open-plan office brought a plate of food to the interaction area to join in. We have to grab a third table and drag it over so everyone can fit. There are people I don’t know and DS explains that there are some people from another office in the building and some scientists visiting from another city. (Observation notes, O20)</td>
<td>The social context of a morning teas created an opportunity for people from different organizations to interact.</td>
<td>The scientists from another city just happened to be visiting the building when the morning tea was happening.</td>
<td>Employees had to take the initiative to interact with new people at the morning tea.</td>
<td>New professional relationship</td>
</tr>
</tbody>
</table>

Table 4.2 Serendipitous encounters in a collaborative science building
Overall, there were two main factors that limited the development of new collaborative relationships in the building. First, there were only a small number of employees in the building who had the intention to collaborate, and who were likely to notice and take up opportunities to meet new people. Second, the chances of a serendipitous encounter leading to new collaborative relationship was quite small, because very few encounters occurred between people who had mutual interests that could be developed into an ongoing collaboration.

In some ways, however, it is surprising that the collaborative science building actually did facilitate the development of any new collaborative relationships. As the interview and observation data revealed, there were many barriers to interaction and collaboration in the building. In particular, the lack of private spaces for open discussions, the existing relationships employees brought to the building, and the different organisational cultures and policies, all made it difficult for employees to experience personal encounters with people from other organisations. In this regard, this research does provide some support for the idea that open-plan offices can facilitate the development of some new collaborative relationships, even under difficult circumstances. Overall, while open-plan offices are a context that can generate opportunities for personal encounters, it is only when people who occupy the open plan office intend to collaborate with one another that these opportunities will manifest in the form of serendipitous encounters.

4.5 Discussion

Previous research has assumed that open-plan offices support collaboration by generating chance encounters (e.g. Boutellier et al., 2008; McCoy & Evans, 2002; Monge et al., 1985). The problem with existing research is that it fails to explain why individuals, who regularly come into physical proximity in walkways, stairwells and photocopy areas, may avoid personal encounters. So why do some employees, and not others, develop new collaborative relationships in open-plan offices? How do these collaborative relationships form? This study provides answers to these questions based on a case study of a collaborative science building.

I found that personal encounters in a physical work environment are rarely purely spontaneous, and instead involve some element of intention. Employees who intend to collaborate are more likely to notice and take up opportunities for collaboration that are presented in the physical work environment. Thus, by chance, a group of employees may be standing together outside a lift, but only those individuals who want to meet new people are likely to initiate and reciprocate interactions that could lead to the development of new collaborative relationships. In the case of the collaborative science building, results show that employees who were sociable, in the early stages of their careers, or who had a formal job role that required them to collaborate, tended to have intentions to collaborate. Furthermore, the social, physical, and organisational context
meant that even employees who intended to collaborate did not always experience personal encounters, because their desire to meet new people was not reciprocated. Overall these results form the basis for theoretical and practical contributions to our understanding of open-plan offices, the physical work environment, and inter-organisational collaboration.

4.5.1 Theoretical contributions

This research contributes to the debate on the link between open-plan offices and collaborative behaviours, such as communication, information sharing and cooperation. Previously, literature in Organisational Behaviour has made two alternate predictions about the relationship between open-plan offices and collaboration. The first prediction is that open-plan offices lack the privacy necessary for people to feel comfortable conversing without being overheard or distracting others. Advocates of the privacy perspective suggest that open-plan spaces can promote hiding behaviour and actually minimise opportunities for working together. The second prediction is that open-plan spaces promote collaboration by bringing people into close proximity and removing physical barriers that inhibit interactions. From the proximity perspective (e.g. Boutellier et al., 2008; McCoy & Evans, 2002; Monge et al., 1985), open environments promote collaboration because they increase the likelihood that employees will experience chance encounters, which are assumed to generate social obligations for interactions.

I advance this debate by providing empirical support for the proximity perspective, but with the addition of some important boundary conditions. My research demonstrates that the proximity generated in open-plan offices can promote personal encounters and collaboration under some circumstances. Consistent with situated cognition theory, the results of this research show that open-plan offices generate opportunities for people to have personal encounters with others in hallways, kitchens, lifts and other shared spaces, but only when the people in those open-plan offices intend to collaborate. In contrast to prior research, where researchers have assumed that personal encounters in open-plan offices occur purely by chance, I found that most personal encounters in open-plan office are better characterised as serendipitous, because they involve elements of both intention and chance. Serendipitous encounters involve chance, because they require two or more strangers to come into physical proximity to one another at an event or in a shared space, but they also involve intention, because strangers must take up opportunities to introduce themselves, seek out common interests, and introduce mutual colleagues to one another. With this insight, my research provides an explanation for mixed findings on the link between open-plan offices and collaborative behaviours, by showing that the intentions of employees shape whether or not they take up opportunities for personal encounters in their office environment.
Secondly, my research contributes to the literature on open-plan offices by focusing on the development of collaborative relationships. My research is one of the first studies to examine how new collaborative relationships are formed in open-plan offices. Existing research has mostly been conducted in the context of small organisations where everyone already knows one another, and where employees often have formal job roles that require them to interact (e.g. Fayard & Weeks, 2007; Hua et al., 2010; Värlander, 2012). As employees already know one another, they are more likely to experience social obligations to interact when they encounter one another in their open-plan office. In contrast to existing research, I explored personal encounters in a building where employees were from different organisations, did not have established relationships, and often had no formal reason to interact.

My research demonstrates that physical proximity alone does not necessarily generate obligations to interact, especially among strangers. This finding is consistent with Hirst (2011), who found that employees in flex offices (where individuals do not have allocated desks) rarely interact with those who sit next to them on a given day. Hirst’s participants suggested that they saw little reason to communicate with the strangers in adjacent desks, because they would be replaced with new people the next day. Similarly, my research reveals that co-locating strangers only promotes personal encounters when the employees who share an office want to interact with one another. Although I found that open-plan offices did generate some obligations to interact among people who already knew one another (i.e. people from the same workgroup), this same obligation did not exist for people who did not know one another (i.e. from different organisations). Thus, simply co-locating people in an open-plan office does not create sufficient conditions for the development of new collaborative relationships.

Consistent with situated cognition theory (Semin & Smith, 2013), my research shows that it is only when employees internalise social norms about collaboration and have intentions to collaborate, that social and physical context will have a positive impact on employees’ collaborative behaviours. In the context of the collaborative science building, employees who were socially oriented, in the early stages of their career, and working in a role that required collaboration with others in the building, were more likely to suggest they were open to finding new collaborators in the building. The specific characteristics that shape employee intentions to collaborate may be different in different organisational contexts. Yet, in general, employees who want to collaborate are more likely to experience personal encounters than employees who do not want to collaborate.

Overall, by conceptualising collaboration as a form of situated cognition, this research contributes to the literature on open-plan offices, collaboration and situated cognition. Specifically, situated cognition theory points to the role of both individual schemas (intentions) and context (physical, social, organisational) as jointly shaping behaviour, and is consistent with the idea that
personal encounters involve both intention (people want to interact) and chance (people happen to be in the same place at the same time). The concept of the serendipitous encounter goes some way to addressing mixed findings in the literature on the link between proximity and collaboration, by showing that employees will take up opportunities for collaboration when it is consistent with their intentions. In summary, this research points to the role of intention, and physical and social context in explaining the development of new collaborative relationships among people from different workgroups or organisations, who are co-located in open-plan offices in a shared building.

4.5.2 Practical contributions

The most important practical implication of this research is that simply co-locating employees in a shared building is unlikely to promote personal encounters or to improve collaboration. In the context of a collaborative physical work environment, my research shows that employees need to believe in the value of collaboration before serendipitous encounters become possible. This suggests a role for managers in convincing employees that interacting with new people is valuable. Specifically, managers can promote personal encounters that span work-group or organisational boundaries, through identifying problems and interests that might be shared by employees from different groups and by emphasising these commonalities in their conversations with employees. Furthermore, managers can organise events that provide employees from different work groups and organisations with a context to meet one another and find out about these commonalities themselves. Finally, managers can take up opportunities to introduce their mutual colleagues to one another and to encourage their employees to do the same. In the context of the collaborative science building, there were particular individuals who saw themselves as social connectors (or boundary spanners), usually because of their personality, formal job role, or because they were in the early stage of their career and developing their own networks. Managers can empower boundary spanners to develop relationships outside of their own work groups, and to introduce people whom they believe have common interests or problems.

Furthermore, managers who wish to improve collaboration need to be conscious of social, physical, and organisational barriers that can impede collaboration, and to put in place strategies to overcome these barriers. When it comes to social barriers, managers can focus on helping employees identify as part of a broader community that extends beyond the boundaries of their immediate work group. For example, they could do this by emphasising their identity as scientists, or as people working in a collaborative building, rather than as members of a particular work group. When it comes to physical barriers, managers need to be conscious of existing patterns of interaction (e.g. people meeting in large or small groups) and try to provide facilities that meet these requirements, especially during renovations or relocation to a new site. Consistent with existing
research (Fayard & Weeks, 2007), my participants emphasised a preference for private and cosy spaces for interaction, rather than expansive, noisy spaces made of glass and metal. This may require managers and employees to have ongoing discussions with architects during design, construction and post-construction phases, to ensure the building meets the needs of users. Finally, managers should be conscious of organisational barriers, such as policies and processes that may have implications for collaboration. Managers should advocate for policy changes that make it easier for employees to collaborate across work-group and organisational boundaries.

4.5.3 Limitations and future research

Although the collaborative science building was a critical case (i.e. a collaborative building where people were not collaborating) that provided an excellent context for understanding the mechanisms that underpin personal encounters, some of the findings may be idiosyncratic to this case. The idea that both intention and chance promote personal encounters is generalisable to other physical work environments; however, the specific individual characteristics that were associated with individuals’ intentions to collaborate (i.e. sociability, career stage, job role) may vary across contexts. It would be interesting to explore in other organisations the factors that shape employee intentions to collaborate. In particular, it would be helpful to investigate factors such as job design (interdependence) and norms (collaborative norms) that influence individuals’ intentions to collaborate, because managers can act to change these factors in order to influence employee intentions and improve collaboration.

Another potential idiosyncrasy of this case was that few employees in the building understood that it was supposed to promote collaboration, believed that collaborating with others in the building was a good idea, or had reasons to collaborate with others in the building. Future research might examine a physical work environment where employees have real incentives to collaborate with others, and explore whether or not serendipitous encounters were more common. One option would be to study teams where employees are interdependent and working towards a shared goal, and where the incentive to collaborate with others is high. By studying teams, it would also be possible to overcome the focus on personal encounters as the only way that physical work environments can shape collaboration. In order to study the relationship between the physical work environment and collaboration, it would be helpful to look at the collaborative behaviours of teams (i.e. cooperation, information sharing, and coordination) to understand how they take place in specific kinds of physical work environments (e.g. open-plan offices). This limitation is addressed in Study 3, which examines team collaboration in open-plan offices.

Finally, this research is limited by its focus on intentions as one type of schema that shapes employee responses to a physical work environment. There are many different schemas that may
interact with the context of the physical work environment to promote or inhibit collaborative behaviour. An avenue for future research could involve examining how different schemas interact with the physical work environment. One way to study this would be to compare different individuals who are working in the same kind of physical work environment (i.e. open-plan offices). This could involve examining collaboration in groups, rather than the development of collaborative relationships between individuals. I address this limitation in Study 2, by examining the conditions under which open-plan offices support collaboration.

4.6 Conclusions

In conclusion, this research challenges widespread assumption in the literature and among practitioners that open-plan offices promote collaboration by generating chance encounters. In doing so, this study contributes to our understanding of open-plan offices, the physical work environment and inter-organisational collaboration, by drawing on the concept of *serendipity* to highlight the role of both intention and chance in fostering personal encounters. Specifically, by adopting a situated cognition framework, Study 1 demonstrates the importance of physical, social and organisational context in generating opportunities for people to engage with each other. Furthermore, it highlights the role of individual intentions in shaping whether or not employees notice and take up opportunities for personal encounters.

Study 1 is significant because it indicates the importance of *individual* intentions in shaping new collaborative relationships in open-plan offices. Yet, collaboration, by definition, is not an individual activity and involves more than one person. Thus, the next chapter explores collaboration among groups of people who share an open-plan office. Specifically, the aim of Study 2 is to explore why some groups in open-plan offices engage in collaboration, and why other groups do not. Insights from Study 1 point to the importance of individual schemas in shaping collaborative behaviours. Thus, Study 2 seeks to extend the findings of Study 1 by more deeply examining the interaction between individual schemas and context, as an explanation for collaboration in open-plan offices.
CHAPTER 5 (PAPER 2): WHY OPEN-PLAN OFFICES CAN HELP AND HARM COLLABORATION

5.1 Link to previous chapter

In this chapter I present Study 2, which is a comparative case study of collaboration in open-plan offices. In Chapter 4, I examine why individuals had different responses to a building that was intended to support collaboration. Specifically, I identify the individual factors that shaped whether or not employees developed new inter-organisational collaborative relationships in the building’s open-plan offices. Thus, I have found that the interaction between individual intentions and the physical, organisational, and social context facilitates collaborative behaviour. To build on the findings from Chapter 4, Chapter 5 examines the interaction between other cognitive schemas and the context of the open-plan office.

In this chapter, I shift my theoretical focus from individual cognition and behaviour to the interaction between individual schemas and the context of the open-plan office. Thus, this chapter is explicitly about the link between the individual and the group and bridges my examination of individual cognition and action in Study 1 (Chapter 4) and my examination of group cognition and action in Study 3 (Chapter 6). Thus, in Chapter 5 I explain the differences between individuals who share an open-plan office and the differences between groups in different open-plan offices. I present Study 2 as a paper with an introduction, methods, results, and discussion section.

5.2 Introduction

Physical work environments consist of the arrangement of physical objects that employees encounter at work, including equipment, layout, and furnishings (Elsbach et al., 2005). Organisations are increasingly using the physical work environment as a strategic tool to help promote particular behaviours in their employees, to shape their corporate cultures, and to promote their brands (Bacevice & Burow, 2015). A recent trend involves organisations adopting physical work environments, such as open-plan offices, to promote collaboration (Chan et al., 2007). Open-plan offices are shared rooms where workstations are freely arranged in groups and where there are no walls and minimal barriers between desks (Bodin-Danielsson & Bodin, 2008). The removal of physical barriers between people is supposed to make it easier for employees to cooperate, coordinate activities, and share knowledge with one another. Thus, open-plan offices are increasingly seen not only as a way of reducing facilities costs, but of minimising the duplication of effort, ensuring employees are working towards common goals, and improving the efficiency of an organisation (Chan et al., 2007).
Collaboration involves two or more people contributing effort to complete a task, including working together, sharing information, and integrating their activities (Rousseau et al., 2006). Despite the claims that open-plan offices can facilitate collaboration, empirical research on the link between open-plan offices and collaboration has been inconsistent (De Croon et al., 2005). Although some researchers have provided evidence that open-plan offices can have a positive impact on communication between employees (Allen & Gerstberger, 1973), support the development of collaborative corporate cultures (McElroy & Morrow, 2010), and facilitate the cross-fertilisation of ideas that underpins innovation (Boutellier et al., 2008), there is a growing group of researchers who have suggested that open-plan offices undermine employee concentration, wellbeing, health, and productivity (Banbury & Berry, 2005; Bodin-Danielsson & Bodin, 2008; Roper & Juneja, 2008). Given these issues, there is a need to investigate the conditions under which open-plan offices are likely to lead to positive, rather than negative, outcomes.

I depart from existing research by conceptualising collaboration as a form of situated cognition that emerges from the interaction between individual cognitive schemas and the context of the open-plan office. Situated cognitions are actions produced by individual mental representations of knowledge (i.e. schemas such as stereotypes, and heuristics) and physical and social contexts (Elsbach et al., 2005). Based on experimental research, physical context (e.g. a warm verses cool room temperature) can influence individual social judgements of others (person schemas), and their subsequent behaviour (sociability, generosity), while experiences of social exclusion (context) can lead individuals to feel physically colder (schema) (Semin & Smith, 2013). Thus, context influences the activation of schemas, and schemas influence how individuals perceive and experience contexts. Consistent with situated cognition theory, I place significant weight on the interplay between psychological and environmental factors when considering the relationship between open-plan offices and collaboration.

In an effort to understand why open-plan offices can have both positive and negative impacts on collaboration, researchers have focused either on contextual variables (e.g. social norms) or on individual variables (e.g. personality). When it comes to context, researchers have conceived of the open-plan office as a physical context where there are few barriers (Bodin-Danielsson & Bodin, 2008; Boutellier et al., 2008; Hua et al., 2010), a social context where employees experience co-presence (Banbury & Berry, 2005; Brennan et al., 2002; Kaarlela-Tuomaala et al., 2009), or as an embodied context where employees are on display or under surveillance (Bernstein, 2012; Edenius & Yakhlef, 2007; Värlander, 2012). Yet empirical research has shown that physical barriers can promote (Hatch, 1987) and inhibit interactions (Boutellier et al., 2008), that co-presence can aid (Fahy et al., 2013) and undermine collaboration (Sundstrom,
Herbert, et al., 1982), and that being able to see, hear, and smell others can both trigger (Edenius & Yakhlef, 2007) and undermine communication (Bernstein, 2012).

Researchers whose explanations have focused on the individual have had more consistent findings, and have shown that employees working on simple tasks (Maher & von Hippel, 2005), who are extraverted (McCusker, 2002), and who can exercise control over their own environment (Lee & Brand, 2010), tend to have more positive experiences in open-plan offices. In Chapter 4, I also find that individual intentions influence the way employees respond to a physical work environment and can influence their decisions to engage in collaborative behaviours. Although researchers have identified some conditions under which open-plan offices can promote positive outcomes, they have not reconciled the impact of contextual and individual factors on shaping collaboration.

Recently, Ashkanasy et al. (2014) have pointed to the importance of examining multiple units of analysis when researching open-plan offices. They argue that the impact of open-plan offices on employee behaviour can only be understood by accounting for differences within individuals (affective reactions), between individuals (attitudes, behaviours), and within teams (interdependencies). Their argument implies that contextual and individual influences must be accounted for when theorising about open-plan offices. Whereas Ashkanasy et al. (2014) grounded their work in Affective Events Theory, to highlight the emotional and relational aspects of working in open-plan offices, I draw on Situated Cognition Theory to illuminate task issues (i.e. collaboration). Thus, I propose the following research question: What are the individual and contextual factors that promote (and inhibit) collaboration among employees in open-plan offices?

To answer my research question, I present a comparative case study of seven open-plan offices in a building that was intended to support collaboration. The results demonstrate that collaboration in open-plan offices emerges from the interaction between schemas (rule, role, and person) and contexts (physical, social, and embodied).

5.3 Methods

Given the mixed findings on collaboration in open-plan offices (Chapter 4), I conducted an inductive study that allowed me to directly observe employee behaviours in the open-plan office, and to understand these behaviours from a perspective that highlights individual, group and physical contexts. Given my view that collaboration arises out of the interaction between schemas and context, a case-study design was appropriate because it provided a holistic view of employee understandings and behaviours in the open-plan office. I employed a qualitative research design, including observation, semi-structured interviews, and comparative case analysis. These research methods were particularly suited to studying the connection between cognition, the physical work
environment, and behaviour, because they allowed me to talk to employees about their experience of the open-plan office as well as directly observe their interactions and behaviours throughout the course of their working days. The comparative case-study approach allowed me to develop an in-depth understanding of the interaction between employee schemas and context in each open-plan office, and to compare the open-plan offices where employees collaborated and where they did not collaborate.

5.3.1 Research setting and participants

I studied groups that occupied open-plan offices in a collaborative science building. The building was located in an Australian city and contained a total of 20 large, open-plan offices. The building could accommodate up to 1000 people and was occupied by scientists and professional employees from three government organisations. I refer to the participating organisations as Organisation 1, Organisation 2, and Organisation 3. Broadly, Organisation 1 had a focus on applied agricultural research, Organisation 2 was involved in environmental management, regulation, and the promotion of science and technology, and Organisation 3 was involved in blue-sky research across a range of scientific disciplines.

The collaborative science building provided a unique opportunity to examine how employees who worked in different roles and for different organisations responded to very similar, shared open-plan offices. Consistent with sample sizes in comparative case-study research, I selected eight groups of people within the building to study in depth. The sample included four groups who worked in noisy offices, where I observed employees engaging in regular interactions and collaboration (Offices 1, 3, 4, 6, and 7), and four groups who worked in quiet offices where there was much less interaction and collaboration (Offices 2, 3, 4, 5, and 8). Yin (1994) recommends selecting multiple cases that are similar to each other, and multiple cases that are predictably different. I followed these recommendations because they allowed me first to compare among the four open-plan offices where employees did collaborate (similar cases), and then to compare the open-plan offices where employees did collaborate with the open-plan offices where employees did not collaborate (different cases). I provide a summary of the open-plan office arrangements and functions of eight groups that participated in the research in Table 5.1.

The open-plan offices in the building varied in size and contained desk spaces for between 20 and 90 people. Most of the offices contained rows of rectangular desks that were separated by chest-high barriers, but a few offices contained boomerang shaped desks that were clustered together freely. Most offices were divided into two sections with shared amenities, including photocopiers, a compactus, and a small kitchen area located in the centre of the office. A larger kitchen area was provided on each floor of the building outside of the open-plan offices. Meeting
rooms, and between 3 and 30 cell offices (individual offices, with four walls and a door), were located at either end of each open-plan area. In the central wing, the two outside walls of the open-plan offices were dominated by glass windows, which looked out into an atrium area and the open-plan offices in the adjacent wings. In the external wings, one wall consisted of glass windows, which allowed employees to see over the atrium and into the open-plan offices in the central wing, and the other was an internal glass wall that exposed laboratory facilities.

**Table 5.1: Cases used in the research**

<table>
<thead>
<tr>
<th>Case</th>
<th>Organisations in the open-plan office</th>
<th>Occupant functions</th>
<th>Number of interviewees</th>
<th>Approximate length of observation</th>
</tr>
</thead>
</table>
| Office 1 | Organisation 1  
         Organisation 2 | Administration  
            Applied science | 6 | 112 hours |
| Office 2 | Organisation 1 | Scientific research | 5 | 112 hours |
| Office 3 | Organisation 1 | Scientific research | 3 | 2 hours |
| Office 4 | Organisation 1 | Scientific research | 6 | 4 hours |
| Office 5 | Organisation 1 | Scientific research  
            Business support | 4 | 2 hours |
| Office 6 | Organisation 1  
         Organisation 2 | Administration  
            Business support | 6 | 8 hours |
| Office 7 | Organisation 2 | Applied science | 4 | 2 hours |
| Office 8 | Organisation 3 | Scientific research  
            Business support | 5 | 3 hours |

5.3.2 **Data collection**

To balance depth and breadth in case-study research, Leonard-Barton (1990) recommends that researchers collect longitudinal, real-time data from one or two cases, and retrospective cross-sectional data from additional cases. Consistent with Leonard-Barton (1990), I examined two cases in depth (Offices 1 and 2), and examined a further 6 retrospective cases through interviews to check my initial interpretations and to identify boundary conditions (see also Bresman et al., 2013; Eisenhardt & Graebner, 2007; Graebner & Eisenhardt, 2004). The in-depth cases allowed me to develop a contextualised understanding of the conditions that influenced collaboration in the open-plan offices, while the retrospective cases provided an opportunity to check the breadth of my
findings and to strengthen their transferability (Welch, Piekkari, Plakoyiannaki, & Paavilainen-Mäntymäki, 2010).

I conducted approximately 112 hours of observation with the employees in Office 1, and 112 hours with the employees in Office 2 (14 days in each office). I selected Office 1 as an example of a noisy office with abundant interaction and collaboration, and Office 2 as a quiet office with much less interaction. I occupied a desk in the open-plan office and used a laptop computer to type up field notes based on my observations of employee interactions in these offices. I did not participate in the work that employees were undertaking, but joined social chats in the office, attended shared morning teas, and attended after-work social events with employees. Although I was unable to take detailed observation notes about the interactions in all of the offices, I did spend time in each, and took notes about my general impressions. I provide an overview of the data collected for each case in Table 5.1.

Alongside observations, I conducted semi-structured interviews with a sample of employees from each of the open-plan offices, to understand the meanings associated with working in the open-plan offices. I interviewed a minimum of three people in each open-plan office in order to cross-check the statements made by people and to ensure that I understood the social, physical, and embodied context of each open-plan office. The selection of multiple interviewees from each office also allowed me to capture variation between employees in the same office, and to understand how employees with different schemas could have different experiences of the same physical work environment.

Interviews were conducted in private meeting rooms in the building to ensure confidentiality. Although an interview protocol was used every time to ensure interviewees were asked a core set of questions, I also asked follow-up questions and allowed participants to discuss issues that were important to them. Standard interview questions included, “How do you feel about working in an open-plan office?” and “Are there things you do differently working in open-plan compared to other office types?” When interviewing participants from Offices 1 and 2, I focused on understanding employees’ opinions about the open-plan office. In later interviews, I included more questions about issues that arose during the observation phase to check if participants in different offices had similar experiences. For example, after I realised that there were very different rules regarding noise, interaction, and body language in the different open-plan offices in the building, I added more questions about informal rules in the open-plan office. The final interview guide is provided in the appendix.
5.3.3 Data analysis

To analyse the data, I first prepared summaries, based around broad themes, about the groups in each open-plan office. Some themes were loosely based on interviews questions (e.g. positive and negative aspects of open-plan offices), while others became evident as I read through the interview transcripts and observation notes (self-monitoring, co-presence). Using these ten broad themes as a guide, I prepared summaries of each case (i.e. each open-plan office), and began to look for similarities and differences within and between cases. At this point I realised there was considerable variation in how employees within cases described their experiences in the open-plan offices. For example, in Office 4 some scientists suggested that they really benefited from being able to interact with colleagues, whereas others complained that the open-plan office had no benefits and that they struggled with distractions. I noticed similarities between cases in terms of the key positives and negatives of open-plan offices, but differences between cases in terms of the level of interaction and noise. I familiarised myself with the cases’ key similarities and differences, and then put aside the initial themes to return to the data and develop codes inductively.

To start the formal analysis process, I uploaded the interview transcripts and observation notes to the qualitative analysis program, NVivo 10 (QSR International, 2014). I present the data analysis process in Figure 5.1. To build theory from comparative case studies, Eisenhardt (1989) recommends that researchers analyse the data using the procedures outlined by Corbin and Strauss (1990). Corbin and Strauss (1990) outline three rounds of coding. In the first round of coding, open-coding, I read through interview codes and observation notes and annotated sections of text with labels that captured their meaning for me. At this stage the codes were about specific features of the open-plan office (e.g. co-presence, layout), the people in the open-plan office (personality, composition, liking others in the office), and employees’ understandings about the open-plan office (space for focused work, space for interactions). I noticed that there were similarities within cases relating to co-presence, layout, and the composition of people in the office, but also differences within cases in how individuals perceived their roles, appropriate office behaviour, and the other people in the office.

During the second phase of coding, axial coding, I returned to the literature to look for a framework that could explain (1) differences between individuals who worked in the same open-plan offices, (2) similarities between individuals who worked in different open-plan offices, and (3) the different patterns of interaction in different open-plan offices. I found that situated cognition theory (Elsbach et al., 2005; Lant, 2002) illuminated these issues. In particular, the concept of schemas explained similarities and differences between individuals, and the concept of context explained differences between open-plan offices. The situated cognition approach encouraged me to
re-examine my data for different schemas and contexts that might shape interactions in each open-plan office. I identified three main contexts (physical, social, and embodied contexts), and three main schemas (rule, role, and person schemas).

![Figure 5.1 Map of the inductive analysis process for Study 2, showing the transition from open-codes (e.g. technology), to high-order codes (e.g. physical context), and a summary statement (i.e. interplay between schemas and contexts helps and hinders collaboration)](image)

In the final stage of analysis, selective coding, I looked for connections between the different contexts and schemas, and continued to examine the data until I could explain the differences and similarities between individuals in the same open-plan office, and the similarities and differences between the different open-plan offices. In this stage of coding, I realised that, (1) the interaction between physical context and role schemas shaped employees’ experience of independent work, (2) the interaction between social contexts and rule schemas shaped employees’ experience of collaborative work, and (3) the embodied context and person schemas shaped who employees collaborated with in their open-plan office. Overall, I found that the combination of schemas and contexts in an open-plan office shaped whether or not it was a collaborative space or a quiet space. I present my findings in the next section.
5.4 Results

This study was motivated by mixed empirical findings on the relationship between open-plan offices and collaboration. Thus, the results of this study answer Research Question 2: What are the individual and contextual factors that facilitate and inhibit collaboration in open-plan offices? I identify three contexts (physical, social, and embodied) and three individual schemas (role, rule, and person) that shape employees’ experiences in open-plan offices. Interplay between these contexts and schemas shape whether or not an open-plan office is used for collaboration. For example, the interplay between physical contexts and role schema facilitated collaboration when the office was large and employees viewed their roles as consistent with collaboration, because employees had access to a large number of potential collaborators. Interplay between physical contexts and role schema inhibited collaboration when the office was large and employees viewed their roles as requiring them to focus, because the employees did not want to work with one another. At the end of the result sections, I describe the interplay between (1) physical contexts and role schema, (2) social context and rule schemas, and (3) embodied context and person schemas.

5.4.1 Physical context

Employee experiences were shaped by four main aspects of the open-plan office’s physical context. These were the layout of the office, the size of the office, storage space, and technology. With reference to layout, employees spoke about how their positioning in the office impacted their interactions with other employees. A technician suggested, “I’m lucky that I’ve got a desk position that’s not directly next to anyone, so I think I’d have a different experience if I was sitting right beside someone” [Science Technician, Organisation 1, I8]. Employees who were located close to main walkways at the front of the office, or who had their backs facing an office entrance, meeting room, or walkway, tended to experience more interactions in the office than employees who were located in a back corner or along the windows. For some employees this increased distractions and interruptions and made it harder to manage privacy. A human relations officer explained,

Where the HR girls sit where I am, there’s a big meeting room behind and the architect had put the door right behind our desks, so there were people always coming and going and stepping out of the meeting room and talking on their mobile phone. We actually had to request that we pay thousands of dollars to get the door moved just so that we don’t have that interruption all the time [Human Relations Officer, Organisation 2, I25].

Other employees suggested that their position in the office cued assumptions about their role. A social scientist suggested that she was regularly mistaken for a personal assistant because her desk was outside a director’s office. She suggested, “I often get asked where someone is, you know, interrupted even if I have headphones on, to ask where a Director might be and I can only assume
that they’re mistaking me for his PA” [Science Communication Officer, Organisation 2, I24]. Overall, an employee’s physical position in the office could shape their interactions with others.

Employees also suggested that the size of the office had a big impact on their interactions. Employees noted that the more people in an office, the more likely there would be personality clashes. A human relations officer suggested, “If you’ve got 60 people in your room, there’s more likely to be someone who’s a bit difficult rather than if you’ve just got five people you work closely with” [Human Relations Officer, Organisation 2, I25]. Sharing the office with a lot of people could be difficult, especially in the largest office, which accommodated over 90 people from multiple organisations. With a large number of people in the office, employees did not know many others personally. As a result, it was impossible to chat with all the people in the office in order to agree on issues such as noise levels and the use of perfumes. A manager argued,

I think smaller office areas where you might only have you know, three or four people in a space, works well… if somebody had something to work on which was really important they could at least turn around to their colleagues and say, “hey I need to work on this, I’m going to need some quiet for a little bit, what are you guys up to today?” … but out here you can’t make that choice. [Manager, Organisation 2, I9]

A number of employees also noted that many desks in the office were empty because of recent job cuts. Some people suggested this reduced the amount of noise and distractions, whereas others argued that the lack of people made the office so quiet that all of their conversations were audible, and generated greater distractions compared to offices where there was a constant buzz of noise.

Limited personal storage space was another contentious aspect of the office’s physical context. Scientists in particular suggested that the move from private offices to open-plan had made storing their personal libraries at their desks more difficult. One scientist complained, “They threw us out of our rooms, put us in open plan, didn’t give us book shelving space and insisted that we throw out our hard copies, and never provided support for a proper digital library source, or personal library” [Scientist, Organisation 1, I14]. Old reports and documents had to be stored downstairs in the library or off-site, which made them difficult to access. As one scientist argued, “it’s not much fun when you get a request for information about something to just sort of say ‘Yeah, it’s out at the archives’” [Scientist, Organisation 1, I19]. Furthermore, scientists could not easily store equipment at their desks, but had to keep it in the basement of the building. One scientist suggested, “You tend to lose track of what’s where and bits and pieces here and bits and pieces there” [Scientist, Organisation 1, I13]. Employees who were in non-scientific roles tended to have fewer issues with the limited storage space in the open-plan office.

Finally, technology had a large impact on how employees were able to use the open-plan office, and in particular, how easily they could access breakout areas. A number of employees suggested they only had access to desktop computers and desk phones, rather than laptops and
mobile phones. This made it difficult for employees to move their work into breakout areas when they needed to focus in quiet. A scientist suggested, “if someone rings you up, you have to be at your desk because the phone is there and your computer is there and you can’t just go in a quiet room because I have… a desktop computer and not a laptop” [Scientist, Organisation 1, I6]. Managers and HR officers, who often had phone calls with employees about personal issues, also suggested that it was difficult for them to manage these calls professionally when they received them at their desk phones. A manager, for example, argued, “you know, there’s the possibility of asking people to wait if they ring and say, just wait while I find a phone somewhere that can’t be overheard, but that’s, to me unacceptable because people sometimes do want to get things off their chest” [Manager, Organisation 1, I3]. Although employees suggested that breakout areas were helpful for managing distractions and privacy, they did not have access to technologies that would allow them to use the spaces effectively.

5.4.2 Social context

I found three main aspects of the open-plan office’s social context that impacted on employees’ level of interaction in the office. These were individual characteristics of people in the office, the tasks being completed by people in the office, and communication about norms that took place among people in the office. With reference to characteristics, levels of interaction were affected not only by the characteristics of individual employees, but by the combination of employees with different characteristics. For example, highly sociable employees who worked alongside less sociable employees often argued that they struggled to keep their voices down, and to remain conscious that their interactions could be disturbing others. A human relations officer suggested, “I’m much quieter [when I work] and particularly with the group that we’re working with, a lot of scientists, a lot of them are very introverted… and I’m totally not… I’m used to it now, but I prefer… background noise” [Human Relations Officer, Organisation 1, I29]. On the other hand, less sociable employees who worked alongside a majority of sociable employees often found the office too noisy, and struggled to manage distractions. As one scientist suggested, “So open plan for me doesn’t work, because you get distractions all the time, particularly if you’ve got people around who are naturally chatty people” [Scientist, Organisation 1, I19]. Overall, employees who were less sociable tended to prefer a quiet office environment with minimal interaction, whereas employees who identified as more sociable generally suggested that they felt most comfortable working in an office with background noise and regular interactions. When employees with different individual characteristics shared an office, this could create some tension.

Alongside individual characteristics, task differences also impacted employees’ levels of interaction in the office. Once again, it was not only the employees’ own tasks that impacted their
experience in the office, but the tasks being completed by the people around them. Employees tended to have positive interactions with their colleagues when they worked in open-plan offices with other people working on similar tasks. As an administrative assistant suggested, “There is scope for saying ‘Okay, we’ve all got the same issues, let’s talk together and develop the process’ …. and I think it gets back to being in that open environment with people doing similar jobs, similar roles, with the same similar frustrations” [Administrative Officer, Organisation 1, I12]. Employees such as administration staff, human relations officers, and science communication officers, who needed to communicate regularly as part of their work, tended to create noisy offices with lots of interaction. On the other hand, scientists who were working on focused, individual tasks, tended to create quiet offices where there was very little background noise or conversation. The main issues arose when employees who needed to make a lot of phone calls, or interact with their colleagues, were located in the same open-plan office as employees who were working on individual, focused tasks requiring quiet. One scientist suggested, “I found that I was sitting near a lot of researchers who were doing a lot of quiet work and here’s me on the phone doing a lot of busy, noisy work… I got the message from several people ‘You’re interrupting my work’.” [Scientist, Organisation 3, I37]. The office either became too quiet for employees to interact without disturbing others, or too loud for employees to concentrate on their tasks. These differences made it difficult for employees working on different tasks to work together.

The final element of the open-plan office’s social context related to communication between employees, particularly to norms of behaviour in the open-plan office. In some offices, employees had very few conversations about issues such as office noise, phone calls, interactions with visitors, and food in the office. Employees often complained about the behaviour of people in other groups, but suggested that they did not communicate their concerns to the people involved. An administration officer suggested, “how have I got the right to tell them to shut up? I mean, I’m the worst offender!” [Administrative Officer, Organisation 1, I10]. In other offices, employees known as “Noise Nazis” were very active in communicating and imposing their understandings about appropriate behaviour on others. A Health and Safety Officer explained, “They’re the ones at the slightest hint of conversation or something will very loudly shush people or walk around and say ‘Would you take that conversation to an office or to a room somewhere’” [Occupational Health and Safety Officer, Organisation 3, I39]. This created an uncomfortable atmosphere where people were afraid to interact. In other offices, employees suggested they were able to communicate about standards of behaviour in a more friendly way. A manager suggested, “I check in with [my colleague] to say if ever I’m talking loudly, you know, I’m not aware of it, just knock on the door and give me a signal—hopefully not a bad one!” [Manager, Organisation 1, I18]. Overall, the way
in which employees communicated about appropriate behaviour was an important part of the social context of the open-plan office.

5.4.3 Embodied context

The final element of the open-plan office that created a context for collaboration was the embodied context, which consists of co-presence, body language, and absence from the office. ‘Co-presence’ conceives of the open-plan office as a space where employees experience mutual attention, emotions, and behaviours. Employees are able to see, hear, and smell one another, and easily engage others in interactions. The employees interviewed raised all the normal issues associated with open-plan offices, such as noise, distractions, lack of privacy, and surveillance by peers and managers. Some employees suggested that it was annoying that they could not escape from other people, for example, when they felt their colleagues were avoiding work, were talking about personal issues, or were bringing smelly food into the office. A scientist suggested she got annoyed “when I see people that should be working and they’re not doing their work, which has nothing to do with me, but I sort of think, oh great!” [Scientist, Organisation 1, I6]. A small number of employees had also experienced perfume allergies, which had lead managers to intervene and create rules that employees needed to go outside to apply deodorants and perfumes. A manager explained,

We’ve had instances where people are spraying perfume in the office, or deodorant in the office environment because they don’t have anywhere else to put it on… somebody can spray it down the end and if you’re sitting over here, it will waft over because of the air conditioning circles, but you won’t have any idea of who it actually is [Manager, Organisation 2, I9].

On the topic of co-presence, many employees suggested that they were conscious of their impact on other people in the office, and careful to modify how loudly they spoke, where they ate their lunch and the kinds of things they talked about, so as not to inconvenience their colleagues. An administrative officer suggested, “you’ve got to look at people and you’ve got to actually think, what’s your personality type and is my behaviour going to be considered offensive, because I’m a very boisterous person and I know that I rub people up the wrong way” [Administrative Officer, Organisation 1, I21].

Body language was an important form of communication in the open-plan office. Employees could manage their interactions with others by adjusting their own body language and by monitoring the body language of others. A number of employees talked about using headphones, not only as a way of screening out noise, but of signalling to their colleagues that they were working. A scientist suggested, “People were not really listening to the music, but if someone
perceives that you have a headphone they won’t talk to you because they know that you’re not listening” [Scientist, Organisation 3, I40]. Some employees also used hand signals to tell their colleagues to quiet down, particularly if they were on the phone. Furthermore, employees suggested that they could minimise distractions and interruptions by directing their attention away from other people to focus on their work. In some offices, employees regularly displayed closed body language by avoiding eye contact and walking through the office swiftly, making it difficult to capture their attention. In other offices, employees displayed more open body language, such as making eye contact, standing up, and approaching others. Over time, employees got to know their colleagues’ idiosyncrasies and were better able to interpret whether others were open to interaction or did not want to be disturbed.

Finally, the embodied context of the open-plan office also relates to individual absences from the office. Many employees choose to remove themselves from the open-plan office as a way of managing distractions, interruptions, and privacy. Employees worked in breakout areas, from home, and outside of normal office hours when there were few other people in the office. These absences shaped interactions because employees were not always present and available for face-to-face interactions. In the open-plan office, people could see who was present and who was absent. Employees got to know their colleagues’ routines and could pick up if someone was away unexpectedly. Employees could communicate with others through their body language and presence in the office, but also through their absence.

Overall, with regard to context, my findings show that the open-plan office is a physical, social and embodied context that shapes collaborative behaviour. Yet it is not just the context of the open-plan office that shapes collaborative behaviour, but the individual schemas of the employees occupying those offices. I found that the role schema, rule schema and person schema of employees interacted with the context of the open-plan office to shape collaborative behaviour. In the rest of the results section, I discuss each of these schemas. I also explain the specific interactions between context and schemas that promote and inhibit collaboration.

5.4.4 Role Schema

Employee role schemas, or their understanding of what their role entailed, profoundly impacted their experience in the open-plan office. Employees who saw their roles as involving focused, individual work or managing confidential information tended to have negative experiences of the open-plan office. Experiences in the open-plan office were not necessarily shaped by the objective requirements of individual roles, but rather the employees’ role schemas: specifically, their understanding about whether or not their job required them to collaborate. Employees working in similar roles, but with different role schemas, expressed very different understandings about how
the open-plan office impacted on their work. For example, some scientists in Office 4 emphasised the importance of individual tasks, such as reading scientific papers, analysing data, and writing, whereas others spoke about the value of interacting with their colleagues. While the objective requirements of individual roles did influence perceptions of role, it was the role schema that shaped how the employee experienced the open-plan office.

Employees who saw their role as involving focused tasks tended to suggest that distractions and interruptions were a negative aspect of the open-plan office. Employees who needed to concentrate on tasks such as learning legislation, scientific reading, and writing reports on short deadlines, emphasised issues related to noise and difficulty concentrating. One scientist suggested that “being a researcher involves a lot of reflective thought and you need peace and quiet to concentrate, to analyse, write up, that sort of thing” [Scientist, Organisation 1, I32]. Employees who had a focused role schema also tended to describe interaction with others in the office as an activity that impeded work, rather than something that was part of their work. One scientist suggested, “I don’t have time to chat to people. I’m here to work” [Scientist, Organisation 1, I6]. As a result, employees with focused role schemas often argued that the other people in the open-plan office were more annoying than helpful. One technician suggested that in the open-plan office, “you’re being distracted constantly by chatter and it’s almost impossible [to get anything done]” [Science Technician, Organisation 1, I2]. Overall, employees with a focused role schema tended to suggest they did not benefit from interactions with others in the open-plan office, and that the office also impeded their ability to work effectively.

Employees tended to experience the open-plan office as a facilitator of collaboration when they viewed working with colleagues seated nearby as a requirement of their role. A science engagement officer, for example, emphasised her role as someone who connected people. She argued that the interaction with colleagues in her open-plan office helped her to do her job, because,

You can incidentally hear conversations and have some input… [It’s also] useful from the perspective of being able to turn around and have a quick conversation … [for] sharing ideas and also great from a just getting-to-know-your-colleagues perspective [Science Communication Officer, Organisation 2, I20].

Thus, employees with a collaborative role schema tended to describe distractions and interruptions as minor issues, or as opportunities to overhear useful information and help others because they valued their colleagues’ knowledge and input. Employees who had little in common with others in their open-plan office did not experience these positive impacts. As a health and safety officer suggested, “There’s certainly no advantage to me working in an open-plan situation with other staff members, I don’t do the same work that they do” [Occupational Health and Safety Officer, Organisation 3, I39]. Scientists, in particular, often suggested that they worked very little with the
people who sat alongside them in the open-plan office, and instead, worked with colleagues located all over the world through phone calls, teleconferences, and email. For example, one scientist argued, “the guy I bounce most ideas off is in Hobart and the other support people are over in Western Australia and in New Zealand” [Scientist, Organisation 3, I27]. Overall, the employees with a collaborative role schema indicated that they benefited most from working with others in the open-plan office.

When they viewed confidentiality as central to their role, employees tended to view the physical context of the open-plan office as undermining collaboration. These employees suggested that much of the work they did with other people needed to be private and that it was difficult to do this work in the open-plan setting. A manager, for example, suggested that the open-plan office made it difficult to have phone conversations with his direct reports, most of whom were located at other sites. He suggested,

When you do start managing people, it’s surprising what information they discuss and necessarily because it impacts on their leave requirements or why they need leave or why this has happened or why that has happened, when there’s divorces, second wives, third wives, children, illnesses in families. There’s a whole range of aspects of human relations that need to remain confidential but it’s difficult in an open-plan environment. [Manager, Organisation 1, II3]

Employees with confidential role schemas also suggested that working in an open-plan office undermined their professionalism, because they could not easily move confidential conversations from the open-plan into a private space. For example, a human relations officer suggested, “It’s quite hard at some point to actually say to somebody on the phone, ‘Look, can I call you back?’ because that could ultimately mean you know, somebody being worse off” [Human Relations Officer, Organisation 2, I26]. Overall, employees with confidential role schemas indicated that the open-plan office provided little privacy and undermined their ability to work effectively with other people.

5.4.5 **Rule Schema**

Employee rule schemas contained information about the kinds of behaviours that are appropriate in the open-plan office. In terms of my research on collaboration, the most important rule schemas are those that outline the open-plan office as a place for focused work, and those that outline it as a space for interaction. Employees who applied the focused-rule schema tended to argue that the open-plan office should be a quiet space. As one scientist suggested, “because of the nature of the work that most of us do, like read, write, people were very aware that no – quiet is good” [Scientist, Organisation 3, I40]. Employees also referred to the protocol they were provided when they moved into the open-plan office, which described appropriate behaviours to maintain the
office as a quiet space. Some of the behaviours listed on this protocol included “speak in a low
voice”, “speak out when people are noisy”, and “use quiet rooms for 2-3 people conversations”.
Employees with a focused-rule schema would strive to manage interactions in the office to avoid
distracting others. A scientist argued,

It’s difficult when you’ve got visitors here and you’re showing them through, or you’re
meeting up prior to coming to a meeting room like this or something, and most of them
don’t work in open plan, so they just kind of speak openly and so on. I’m very mindful and
sort of feel a bit guilty sometimes when that happens. [Scientist, Organisation 1, I33]

Employees actively tried to maintain the open-plan office as a quiet space by taking phone calls
outside of the office, by talking in a lowered voice, and by moving long interactions into breakout
areas. A human relations officer argued, “Everyone makes equal effort to make everything very
quiet” [Human Relations Officer, Organisation 1, I28]. For employees with a focused-rule schema,
the open-plan office was a quiet space for focused work. Thus, from this perspective, noise and
interactions should be moved outside of the open-plan office, to breakout areas and other spaces
where noise is not intrusive.

Other employees described the open-plan office as a space for interaction. Employees with
an interaction-rule schema generally expected that the open-plan office was a noisy space where
people could chat to one another. A manager suggested, “in the rooms where they actually are really
quiet, if I go into see anyone you feel like you’re making far too much noise and you’re actually
imposing on their work space more, whereas I prefer this where it’s just, everyone’s going about
their business” [Manager, Organisation 2, I1]. Employees with interaction-rule schemas also
expected that their colleagues would generally be available for interaction. As an administrative
assistant suggested, “I’m not a fan of sitting with earpieces in my ears, so I don’t do that and
sometimes it’s sort of annoying when other people do it, because… instead of getting up and going
to someone, you [want to call out] “hey”… but you don’t, just because they’ve got earpieces in their
ears” [Administrative Officer, Organisation 1, I11]. Employees also tended to ignore the formal
protocol they received when they first moved into the office, which implied that the open-plan
office should be a quiet space. Despite this protocol, a human relations officer suggested, “I think
they were sort of cautious and really careful for a while, but then you just sort of slip back into what
you’re kind of used to, so people talking loud, or they may be standing near your desk chatting on
their mobile” [Human Relations Officer, Organisation 2, I25]. Overall, employees with an
interactive rule schema viewed the open-plan as somewhere where people should talk to one
another and work together.
5.4.6 Person schema

Finally, employees in the open-plan offices had person-schemas, which contained information about the preferences, knowledge, beliefs, and expected behaviours of others. Employees had varying degrees of knowledge about other people in the open-plan office. Some employees had detailed knowledge about the people who sat near them. For example, a science communications officer described the work being completed by another group in her office: “They’re to do with databases and a lot of them are old photographers, so a lot of mapping, a lot of mapping gets done by a few of the people here and database administration, so there’s a range of different databases” [Science Communication Officer, Organisation 2, I24]. Other employees suggested that the open-plan office helped them to learn about the employees in their own group and adjacent groups. A human relations officer suggested that the open-plan office “makes a difference because you get to know so many people around you and you get to know so many people who are working in the same, or different, teams” [Human Relations Officer, Organisation 1, I28]. When employees knew the people around them, they found it easier to anticipate others’ emotions and respond effectively. For example, a human relations officer suggested, “we know so much about each [other] now and because we interact all the time, when we don’t expect [a] bad mood, at least one of us will probably approach that person and be like ‘Is everything okay?’” [Human Relations Officer, Organisation 2, I26]. Overall, when employees had accurate person-schemas about the other people in their open-plan office, they were able to interact and work together.

In contrast, some employees knew very little about the people who sat next to them in the open-plan office. In some of the larger open-plan offices in the building, there were multiple teams from multiple organisations working in the same space. Employees from these different groups did not always have formal relationships with one another, and as a result, had little reason to get to know each other. One scientist noted, “I don’t know if it’s just the stranger element. There’s a lot of traffic of unknown people walking around” [Scientist, Organisation 1, I31]. Employees suggested that simply being co-located in a shared office did not allow them to develop person schemas about the other people they sat next too. An administrative officer explained,

You don’t know who you’re sitting next to, sadly enough. Like, within 5m from where I sit, across the hallway, I wouldn’t have a clue what those people do… I don’t know if they’re [Organisation 1] or [Organisation 2] or – I wouldn’t have a clue. Never asked. That’s the worst thing about it is that usually I’d be knowing exactly who’s who and what’s what on a floor you’re working in. [Administrative Officer, Organisation 1, I21]

In some instances, employees suggested they did not feel comfortable interacting with other people in their open-plan office or discussing issues such as noise and phone calls. A scientist suggested,
“It’s not possible to [coordinate] when you’ve got 30 people just in there, particularly when people don’t necessarily know each other… that’s just too hard a conversation to have with someone that you really don’t know very well” [Scientist, Organisation 3, I27]. Overall, employees who did not have person-schemas about others in the open-plan office found it harder to interact, and spent little time working with others in the office.

5.4.7 The interaction between contexts and schemas

Having discussed contexts and schemas separately, I now focus on the interplay between contexts and schemas. I found that the interplay between specific contexts and specific schemas led employees to experience particular situated cognitions (e.g. valuing interactions with others in the open-plan office, empathy for colleagues’ need to interact), and that these situated cognitions shaped whether the open-plan office facilitated or hindered collaboration. Table 5.2 shows the interactions between contexts and schemas that promote collaboration, while Table 5.3 shows the interactions between schemas and contexts that hinder collaboration. In this section, I will describe the situated cognitions that emerged from the interplay between (1) physical context and role schemas, (2) social context and rule schemas, and (3) embodied context and person schemas. I will also explain how the situated cognitions emerging from the interplay between schemas and context shaped whether or not employees used the open-plan office to collaborate.

Physical context and rule schemas shape individual work: The interplay between physical context and role schemas produced a situated cognition about the degree to which an individual values interaction with others in their open-plan office. When employees who worked in large open-plan offices with lots of other people (physical context) viewed their roles as requiring them to work with others in the open-plan office (collaborative role schema), they experienced a situated cognition of valuing interaction with others in their office, which led them to use the open-plan office to collaborate. For example, the science communication team in Office 7 consisted mainly of employees who viewed collaboration as a central part of their role. Employees in this team had made efforts to interact with, and get to know, people from other groups in their open-plan office. In Office 7, employees benefited from sharing their office with a large number of people, because their roles involved collaborating and working with others. Employees with collaborative role schemas who worked in large open-plan offices tended to collaborate because they valued the knowledge of the other people in their office.

Conversely, large open-plan offices hindered collaboration when they were occupied by employees with focused-role schemas. When employees who worked in large open-plan offices with lots of other people (physical context) viewed their roles as requiring them to work independently (focused role schema), they experienced a situated cognition of valuing the ability to
focus without being interrupted by others in the open-plan office, which led them to use the open-plan office for individual work. In Office 3, for example, scientists described their role as involving focused work, high pressure, and tight deadlines. In a large open-plan office it was very difficult for employees to coordinate with a large number of people and to create a quiet environment for focused work. Furthermore, employees described other groups as performing work that was very different to their own. Employees with focused role schemas who worked in large open-plan offices did not collaborate because they did not value the knowledge of the other people in the office and saw themselves as working independently.

Open-plan offices generated collaboration when employees with focused or confidential role schemas had access to technologies that enabled them to use breakout areas. The interplay between access to technology (physical context) and an understanding that work needs to be conducted alone (focused role schema), or with sensitivity to private information (confidential role schemas), led employees to experience a situated cognition in the form of an expectation that interactions will be conducted outside of the open-plan office. In Office 2, scientists suggested that mobile phones and laptops allowed them to easily move interactions or private discussions into breakout areas. Moving discussions into meeting rooms allowed employees to engage in the interactive aspects of collaboration without impeding the ability of other employees to progress individual tasks. Similarly, by taking phone calls outside of the office, employees were coordinating with the colleagues around them in the open-plan office to ensure that they could progress their individual work without distraction. This meant that even when they were not interacting, employees needed to coordinate with one another to make sure everyone in the office could progress individual tasks. Employees in Office 2 also had the option of working a few days from home and could complete tasks that required concentration on the days that they were not in the open-plan office. Employees with focused or confidential role schemas, who had access to appropriate technology, were able to collaborate because they could easily move their interactions into private spaces. This meant they were able to have face-to-face and phone interactions, without distracting their colleagues or risking the confidentiality of their collaborators.
### Table 5.2: When do open-plan offices help collaboration?

<table>
<thead>
<tr>
<th>Interaction between schema and context</th>
<th>Why this interaction helps collaboration</th>
<th>Situated cognitions</th>
<th>Outcome</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical context (office size) + role schema (collaborative role)</td>
<td>Employees need to interact to do their jobs</td>
<td>Valuing interactions with others in the open-plan office</td>
<td>Employees use the open-plan office for collaboration</td>
<td>Office 7</td>
</tr>
<tr>
<td>Physical context (access to technology) + Role schema (focused role/confidential roles)</td>
<td>It is convenient for employees to move their work outside of the open-plan office</td>
<td>Expectation that interactions will be conducted outside of the open-plan office</td>
<td>Employees use breakout areas for collaboration</td>
<td>Office 2</td>
</tr>
<tr>
<td>Social context (homogeneous role composition) + rule schema (space for interaction)</td>
<td>Employees have shared understandings about how to behave in the open-plan office</td>
<td>Empathy for colleagues’ ongoing need to interact</td>
<td>Employees use the open-plan office for collaboration</td>
<td>Office 6</td>
</tr>
<tr>
<td>Social context (communication about norms) + unshared rule schema (space for interaction/space for focus)</td>
<td>Employees have shared understandings because they communicate about how to share the open-plan office</td>
<td>Empathy for colleagues’ ongoing need for quiet/need to interact</td>
<td>Ongoing verbal communication about whether employees should use the open-plan office for collaboration</td>
<td>Office 5</td>
</tr>
<tr>
<td>Person schema (knowledge about others) + Embodied context (body language)</td>
<td>Employees monitor colleagues’ body language and adjust their behaviour</td>
<td>Empathy for colleagues’ momentary need to interact for quiet</td>
<td>Ongoing non-verbal communication about whether employees use the open-plan office for collaboration</td>
<td>Office 2</td>
</tr>
</tbody>
</table>

### Table 5.3: When do open-plan offices hinder collaboration?

<table>
<thead>
<tr>
<th>Interaction between schema and context</th>
<th>Why this interaction hinders collaboration</th>
<th>Situated cognitions</th>
<th>Outcome</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical context (office size) + role schema (focused role)</td>
<td>Employees do not need to interact to do their job</td>
<td>Valuing the ability to focus without being interrupted by others in the open-plan office</td>
<td>Employees use the open-plan office for individual work</td>
<td>Office 3</td>
</tr>
<tr>
<td>Physical context (no access to technology) + Role schema (focused role/collaborative role)</td>
<td>It is inconvenient for employees to move their work outside of the open-plan office</td>
<td>Perception that self and others are desk-bound</td>
<td>Employees are frustrated by distractions and lack of privacy</td>
<td>Office 4</td>
</tr>
<tr>
<td>Social context (heterogeneous role composition) + rule schema (space for interaction)</td>
<td>Employees have different understandings about how to behave in the open-plan office because they do different work</td>
<td>Difficulty empathising with colleagues’ ongoing need for quiet</td>
<td>Employees are frustrated by distractions and lack of privacy</td>
<td>Office 1</td>
</tr>
<tr>
<td>Social context (no/poor communication about norms) + unshared rule schema (space for interaction/space for focus)</td>
<td>Employees have different understandings because they do not communicate about how to share the open-plan office</td>
<td>Difficulty empathising with colleagues need for quiet/need to interact</td>
<td>Employees do not discuss how to share the open-plan office or are “Noise Nazis”</td>
<td>Case 8</td>
</tr>
<tr>
<td>Person schema (no knowledge about others) + Embodied context (body language)</td>
<td>Employees ignore colleagues’ body language</td>
<td>No attention given to colleagues’ momentary need for quiet/to interact</td>
<td>Employees are not comfortable approaching others</td>
<td>Office 6</td>
</tr>
</tbody>
</table>
Open-plan offices hindered collaboration when employees with focused or confidential role schemas were unable to access technology that allowed them to easily move interactions outside of the open-plan office. The interplay between having little access to technology (physical context) and the understanding that work needs to be conducted alone (focused role schema), or with sensitivity to private information (confidential role schemas), led employees to experience a situated cognition in the form of a perception that the self and others are desk-bound. Unlike scientists in Office 2, scientists in Office 4 complained that they were bound to their desks because most of their calls came through their desk phones. Employees in Office 4 also suggested social interactions tended to happen in the open-plan office rather than in breakout spaces, which meant at times it could be difficult to concentrate. Employees could not carry out collaborative interactions in the office without disturbing others, and could not easily escape to breakout areas to avoid distraction. Furthermore, some employees in Office 4 were unable to work from home because of the nature of their research and their manager’s rules. Overall, these employees struggled to manage distractions, which made them reluctant to work together.

Social context and rule schemas shape interaction: An open-plan office facilitates collaboration when employees share the office with people doing similar roles, and have shared rule schemas that include a view of the open-plan office as a space for interaction. The interplay between a social context where everyone is completing similar tasks (heterogeneous role composition) and an understanding that it is appropriate to interact in the open-plan office (rule schema) produces a situated cognition in the form of empathy for colleagues’ ongoing need to interact. For example, in Office 6, employees worked in administration and business support roles, which were similar because they required employees to regularly interact with others outside of their own work group. As employees were working in roles with similar requirements for communication, they also had shared rule schemas that the open-plan office was a space for interaction. As a result of their shared rule schemas, Office 6 was a relatively noisy space where employees were able to collaborate with others.

In contrast, collaboration was more difficult in open-plan offices that were shared by employees working on very different tasks. In these offices, some employees tended to view the office as a space for interaction, whereas others viewed the office as a space for focus. The interplay between the social context (heterogeneous role composition) and rule schema (open-plan office is a space for interaction) lead employees to experience difficulty empathising with their colleagues’ ongoing need for quiet. Employees in Office 1, for example, included contract managers, executive officers, and middle managers, who all spend a lot of time interacting, as well as soil scientists and computer programmers, who mainly work on individual, concentrated tasks. As employees in
Office 1 were working on different tasks and had different rule schemas, they had difficulty appreciating the kind of environment that others needed in order to work productively. As a result, the employees whose roles required them to interact frequently were able to collaborate with each other, but ended up creating distractions for the employees who needed quiet to focus. Collaboration can be difficult when employees do different types of work and have different understandings about how to behave in the open-plan office.

Open-plan offices support collaboration when employees with different rule schemas communicate with one another about appropriate behaviour in the open-plan office. The interplay between the heterogeneous rule schemas of employees (the open-plan offices is a space for interaction/the open-plan office is a space for focus), and a social context where employees discuss norms about interaction, leads employees to experience empathy for their colleagues’ ongoing need for quiet or ongoing need for interaction. In Office 5, for example, employees working in scientific roles tended to have a rule schema that the open-plan office was a space for focus, whereas employees working in human relations roles tended to have a rule schema that the space was for interaction. Unlike in Office 1, where employees were unable to reconcile their different rule schemas, employees in Office 5 communicated about appropriate behaviour. A scientist, for example, suggested that he felt comfortable asking his colleagues to keep the noise down: “generally people are pretty good about it, particularly if you bring it up in a humorous way” [Scientist, Organisation 1, I32]. Even though the human relations officers preferred the open-plan office to be a space for interaction, they understood that the scientists needed a quiet space to focus. One of the human relations officers suggested that keeping the office quiet had “become a part of life” [Human Relations Officer, Organisation 1, I28], while another human relations officer suggested, “I notice it every day where I try and not to [talk loudly], but it’s part of, I suppose, just respect” [Human Relations Officer, Organisation 1, I29]. Although employees in Office 5 had different rule schemas about interacting in the office, they communicated their differences to one another and were able to work together by moving interactions outside of the open-plan office.

In contrast, open-plan offices hinder collaboration when employees with different rule schemas are unable to effectively communicate with one another and to set shared standards of behaviour. In this case, the interplay between a social context where employees do not discuss how to behave in the open-plan office, and heterogeneous rule schemas about whether open-plan offices are an appropriate or inappropriate space for interaction, produces a situated cognition in the form of, difficulty empathising with colleagues’ ongoing need for interaction or ongoing need for quiet. Employees from Organisation 3 in particular suggested that they had issues communicating with each other about noise. Some employees were very aggressive about telling others that they needed to be quiet. This created an environment that was not conducive to collaboration, because
employees felt too inhibited to talk to one another or make noise in the office. Even when employees chatted about standards of behaviour and agreed that it was acceptable to take phone calls and have work-related conversations in the office, employees with a focused-rule schema still felt that the office should be a quiet space, and felt uncomfortable about making calls at their desk. This suggests that employees needed to adopt interaction-rule schemas, as well as communicating about norms, in order to collaborate in the open-plan office.

*Person schema and embodied context shape who collaborates:* Open-plan offices promote collaboration when employees have accurate person-schemas about the other people in the office, and also monitor the body language of others. The interplay between an employee’s accurate knowledge about their colleague (accurate person-schema) and the body language displayed by that colleague produces a situated cognition in the form of *empathy for colleagues’ momentary need to interact or for quiet*. For example, in Office 2, the scientists and the technicians all worked for the same organisation, and most people in the office knew one another. This meant that employees were able to read one another’s body language and make accurate assumptions about whether or not their colleagues would mind being interrupted. Employees regularly displayed closed body language at their desks and when moving through the office, for example, avoiding eye contact and walking quickly. Most of the office’s interaction occurred at a small area in the middle, where there were facilities for making tea. Employees could easily interact in this area because they knew they were not interrupting or harming their colleagues’ concentration. Collaboration was supported in this office because employees knew their colleagues and monitored their body language to select an appropriate time to interact.

Conversely, the open-plan office hindered collaboration between groups in Office 6. Employees from multiple organisations occupied this office and they did not know one another personally. Thus, the interplay between an employees’ person schema (no knowledge about another person in the office) and the act of seeing their colleagues’ body language (embodied context) did not trigger a situated cognition in the form of *empathy for colleagues’ momentary need to interact or for quiet*. Instead the employee would ignore the other person. For example, employees in Office 6 had accurate person-schemas for the other people in their own work group and could use body language to identify if their colleagues were open to interaction, busy, or upset. Although employees could monitor the body language of people outside of their own group, they did not know these people, and so did not feel comfortable approaching and interacting with them. This suggests that the open-plan office promotes collaboration when employees have opportunities to develop accurate person-schemas for the people around them. When employees understand each other’s preferences, values, knowledge and beliefs, they are better able to understand each other’s body language and adjust their own behaviour accordingly.
5.5 Discussion

The aim of this study is to explore the context in which open-plan offices can promote collaboration. Consistent with situated cognition theory (Elsbach et al., 2005), I found that individual cognitive schemas interact with the context of the open-plan office to facilitate collaboration. The results suggest that open-plan offices will facilitate collaboration when people in the office have similar rule schemas, when they discuss different rule schemas to come to a shared agreement about how to behave in the office, when individuals view their roles as involving collaboration with people in their immediate work environment, and when people monitor one another’s body language and adjust their own behaviour to respect the needs of their colleagues.

5.5.1 Theoretical contributions

Firstly, this research contributes to the debate about the relationship between open-plan offices and collaboration. Existing research has revealed mixed findings, with some studies showing a positive relationship between open-plan offices and collaborative behaviours, and others suggesting a negative impact (De Croon et al., 2005). These findings may be mixed because researchers have tended to focus either on individual explanations (e.g. personality, tasks, perception of environmental control), or on contextual explanations (e.g. social norms, physical layouts, co-presence of bodies). I contribute to this research by showing that collaboration in open-plan offices depends on the interplay between individual factors (schemas) and contextual factors (physical, social, embodied). By integrating both contexts and schemas into an explanation of collaborative behaviour in open-plan offices, this study answers Ashkanasy et al.’s (2014) call to incorporate multiple units of analysis into explanations of behaviour in open-plan offices.

In terms of the physical context of the office, researchers are divided on whether or not open-plan environments support collaboration. Some researchers argue that a short distance and minimal barriers between desks can facilitate collaboration by providing opportunities for employees to engage in chance encounters (see also Boutellier et al., 2008; Monge et al., 1985; Zahn, 1991), while others suggest that private physical contexts enhance collaboration because employees are able to express themselves honestly and at length without being overheard (Brennan et al., 2002; Hatch, 1987; Sundstrom, Herbert, et al., 1982). I contribute to this debate by showing that it is the interaction between the physical features of the office (barriers and distance between desks) and employees’ role schemas that shape whether or not employees will use the open-plan office to collaborate. When employees view their roles as requiring them to interact with others in the office (e.g. “bouncing around ideas”), they will embrace the opportunities for open and free-flowing conversation in an environment with few barriers. Conversely, if employees perceive their
role as being about managing confidential issues (e.g. HR issues) or about doing individual work (e.g. scientific reading and writing) the lack of privacy in the open-plan office makes face-to-face collaboration very difficult.

Similarly, researchers who study the open-plan office as a social context have conflicting ideas about how the presence of other people shapes employee behaviour (Banbury & Berry, 2005). Although Fahey and Easterby-Smith (2013) show that people are more likely to be cooperative when they are in the presence of others (see also Frith & Frith, 2012), Pepper (2008) has found that employees in open-plan offices may avoid engaging their colleagues in conversation because they feel guilty about disrupting others. My research suggests it is critical to account for the interaction between employee composition (social context) and the rule schemas of individual employees in the office to understand whether or not employees will collaborate. I found that when the majority of people in an open-plan office have a rule schema that views the open-plan office as a noisy space for collaboration, they are likely to collaborate with one another. Yet, when a majority of people have a rule schema that views the open-plan office as a space for quiet work, they are more likely to be conscious of disturbing others and avoid interactions.

In addressing social context, my study also supports research that shows that social norms shape employee responses to the physical work environment (Fayard & Weeks, 2007; Pepper, 2008; Värlander, 2012). I extend the research on social norms by showing that employees with shared understandings (e.g. common rule schemas) are more likely to agree on whether the open-plan office should be a space for collaboration or for quiet work. Specifically, norms for collaboration (or for quiet) may organically develop when the people in the office are similar (e.g. working in similar roles, have similar levels of sociability) or when employees communicate to make their expectations about appropriate behaviour in the office explicit to others. In contrast to Brennan, Chugh and Kline (2002), who suggest that open-plan protocols may be a way for employees to develop norms for working in the open-plan office, my research suggests that employees often ignore protocols that are implemented from the top down. Consistent with Laframboise, Nelson and Schmaltz (2006), my findings suggest that open-plan protocols may be more effective when they are developed from the bottom-up, by employees openly communicating about rules for behaviour in the office.

In terms of embodied context, this study also contributes to the debate about the consequences of visible bodies in open-plan offices. Although Edenius and Yakhlef (2007) argue that when an employee sees a colleague in the open-plan office this can trigger a question in their mind that leads them to initiate communication, Värlander (2012) suggests that when employees can see one another it is easier for peers to enforce rules that limit noise and communication. In terms of explaining these mixed findings, my research reveals that it is not just the visibility of
bodies in open-plan offices, but the combination of seeing someone and having a person schema about them (e.g. whether they are a colleague or a stranger) that shapes collaboration. I find that although employees would regularly initiate interactions with people from their own workgroup in the open-plan office, if someone from another workgroup walked past, they tended to ignore them.

The findings of my research also suggest that when employees develop accurate person schemas about the people in their open-plan office, they can better interpret the meaning of other people’s body language and decide whether they are interrupting or annoying others. This research reveals that many employees are quite conscious of monitoring other people’s body language and adjusting their own behaviour. Paradoxically, this means that the ability to see bodies in an open-plan office can both inhibit and facilitate collaboration. People can use their bodies to signal openness to interaction, but also to show that they do not want to be disturbed. Furthermore, employees could limit the ability for others to engage them in face-to-face collaboration by removing their bodies from the office and working in another place.

Alongside debate on mixed findings in open-plan offices, the findings of this research extend the literature on trade-offs and tensions in open-plan offices (Elsbach & Pratt, 2007). Ashkanasy et al. (2014) draw attention to research that shows open-plan offices can have both positive and negative impacts on employees, to argue that open-plan offices produce surprises, paradoxes and tensions. While open-plan offices can potentially have a positive impact on collaboration (Heerwagen et al., 2004), they also have drawbacks such as distractions and lack of privacy (Roper & Juneja, 2008). With regard to this debate, Kim and de Dear (2013) argue that any potential improvement in communication in open-plan offices is offset by the negative issues related to distractions and reduced privacy.

A limitation of the tensions and trade-off perspective (Elsbach & Pratt, 2007) is the assumption that open-plan offices always produce certain outcomes (e.g. improved collaboration, reduced satisfaction). The findings of my research challenge this assumption by showing that open-plan offices will only produce potential positive impacts (e.g. collaboration), under certain circumstances. In this study, employees intended to use the open-plan office to collaborate when they viewed their role as requiring them to work with others in the office (role schema), viewed interaction as appropriate behaviour in the open-plan office (rule schema) and knew the other people in their office (person schema). The employees who did not intend to collaborate viewed their role as requiring them to work predominantly alone (role schema), saw the open-plan office as a quiet space where you should avoid distracting others (rule schema), and knew the other people they were working with. Whether or not the office as a whole was used for collaboration depended on the combination of people in the office. If most people wanted to collaborate, it was a noisy office; if most people did not want to collaborate, it was a quiet office.
Finally, my research contributes to the literature on cognitive underpinnings of collaboration. Researchers who study collective cognition argue that individuals are able to collaborate effectively when they have overlapping schemas about tasks and about each other (Ayoko & Chua, 2014; Mohammed, Ferzandi, & Hamilton, 2010). In a review of the literature, Ren and Argote (2011) show that the focus of existing research on collective cognition is typically on the role of individual characteristics (demographics, competence, assertiveness) and social context (team familiarity, interdependencies, communication) as the foundation for collaborative behaviour. With the exception of a few studies on technology and geographical distribution, researchers typically ignore the physical context within which collaboration unfolds (Ren & Argote, 2011). Thus, I extend research on the collective cognitive foundations of collaboration, by providing empirical support for the idea that collaboration is a form of situated cognition that emerges from the interaction between individual schemas, social context, and physical context. Specifically, I show that the physical context of the open-plan office, in terms of its layout and size, storage space, and access to technology, can shape whether or not employees collaborate.

Furthermore, most of the research on collective cognition has been conducted in fast-paced environments, with military personnel or pilots (Mohammed et al., 2010). I extend this research by applying it to groups of people working in an open-plan office environment. Consistent with the literature on collective cognition in fast-paced environments, my study suggests that people who share open-plan offices need overlapping schemas about roles, rules and other people in the office to collaborate. Also consistent with research on collective cognition, I demonstrate that people sharing an open-plan office communicate to develop overlapping schemas about appropriate behaviour (Hollingshead, 1998; Peltokorpi, 2004). By discussing their expectations, employees can develop accurate person schemas about others in their open-plan office, and are able to better anticipate their colleagues’ behaviour. Overall my findings provide support for the idea that collaboration in open-plan offices is enabled by a combination of individual, social and physical factors.

5.5.2 Practical contributions

Alongside theoretical contributions, this study also points to practical steps that managers can take to foster collaboration in open-plan offices. Firstly, open-plan offices are likely to facilitate communication and collaboration when employees see the value of working with the other people in the office. This means that managers need to co-locate employees who are working on similar tasks, or who need to work together as part of a team. Secondly, employees need to be able to access breakout areas and portable technologies (e.g. laptops, mobiles) so that they can escape a noisy open-plan office to do focused work, or can leave a quiet open-plan office to have noisy or
private conversations. Thirdly, managers can facilitate open communication among employees in the open-plan office so that the employees can discuss and agree on how to share the space.

Furthermore, managers can help employees sharing an open-plan office to learn the roles, work styles, and preferences of others (i.e. develop accurate person schemas). This could be developed through formal training or by helping employees to develop an open-plan protocol from the bottom up. This protocol should outline broad principles for using the open-plan office (i.e. is it a quiet space for focused work or a noisy space for interaction?). When employees understand the impact of their own behaviour (e.g. noisy conversations) on their colleagues, they are better able to monitor the body language of their colleagues and adjust their behaviour. For example, when employees can see that their colleagues are stressed or need to focus, they can avoid unnecessary interruptions and minimise noisy conversations.

5.6 Conclusions

The aim of this study is to understand the individual and contextual conditions under which open-plan offices facilitate collaboration. In the previous chapter (Chapter 4), I identify both individual schemas (intentions) and context (social, physical, and organisational) as important factors that shape collaborative behaviour. In this chapter (Chapter 5), I confirm the importance of schemas and context for collaboration, and also explore the interactions between different schemas (roles, rules, and person) and contexts (physical, social, and embodied) in more detail. I find that the open-plan office facilitates collaboration when most of the employees in the open-plan office have role, rule, and person schemas that are consistent with collaboration. Specifically, employees engage in collaborative interactions in the open-plan office when they (1) understand their job as involving collaboration, (2) think it is appropriate to interact in the open-plan office, and (3) want to collaborate with the other people in the open-plan office.

Overall, the findings of Chapter 4 and 5 suggest that open-plan offices are likely to support collaboration when employees work in a team, because employees need to collaborate to achieve shared goals. I examine this idea further in the next chapter (Chapter 6) by exploring team collaboration in open-plan offices. In Chapters 4 and 5, the focus is on explaining the presence or absence of collaboration in specific physical work environments. I shift the focus in Chapter 6 to explore how employees use open-plan offices to collaborate.
CHAPTER 6 (PAPER 3): THE OPEN-PLAN OFFICE AS A COLLABORATIVE SCAFFOLD

6.1 Link to previous chapter

In Chapter 5, I examine the conditions under which open-plan offices promote collaboration. I am interested in understanding whether or not open-plan offices can help employees to work more collaboratively, and in understanding when collaboration is and is not likely to occur. In contrast, in this chapter I examine employees whose jobs require them to collaborate. The findings that open-plan offices support collaboration when occupied by employees who want to collaborate (Chapter 4), and who are surrounded by people they need to work with (Chapter 5), led me to examine teams in open-plan offices. I chose to examine teams because they consist of individuals who have interdependent relationships and roles, and are working towards shared goals. This interdependence means that team members need to collaborate with one another in order to be successful. Thus, in this chapter, I explore how open-plan offices shape collaboration among team members.

This chapter shifts its focus away from individual behaviour (Chapter 4), and the interaction between individual schemas and context (Chapter 5), towards consideration of collaborative behaviour in teams. Consistent with situated cognition theory, I assume that collaborative behaviours are underpinned by communication processes that enable team members to externalise their thoughts and process information as a group (Gibson & Earley, 2007). This means I focus on how team members work together to achieve shared goals and also consider how cognition is extended onto the physical work environment.

6.2 Introduction

Many tasks are too complex to be carried out by individuals, so organisations rely on the abilities of multiple people who work as a team to combine their expertise, skills, and efforts to perform such tasks (DeChurch & Mesmer-Magnus, 2010; West, Brodbeck, & Richter, 2004). A team consists of three or more individuals who are working towards a shared goal, and who must carry out interdependent activities to reach that goal (Kozlowski & Ilgen, 2006). Teams may be interdependent in terms of task-flow (i.e. the day-to-day interactions required to complete work), goals (i.e. shared aims that can only be achieved with input from all team members), or outcomes

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3 A shorter version of this paper was accepted to the 76th Annual Meeting of the Academy of Management in Anaheim, California.
(i.e. team members are rewarded or get feedback on the performance of the whole team) (Gully, Incalcaterra, Joshi, & Beaubien, 2002). All of these forms of interdependence create incentives for team members to work collaboratively.

Collaboration involves three behaviours: cooperating (i.e. working together), coordinating (i.e. integrating activities), and sharing information (Rousseau, Aube, & Savoie, 2006). Teams often have trouble collaborating because team members may replicate work (Rico, Sanches-Manzanares, Gil, & Gibson, 2008), or engage in conflict (Ayoko, Callan, & Hartel, 2008). Given these issues, organisations have started to look for ways to improve collaboration in teams. A recent trend is for organisations to combine team structures and open-plan offices to enhance information sharing, cooperation and co-ordination within teams (Boutellier, Ullman, Schreiber, & Naef, 2008; Moultrie et al., 2007; Wineman, Kabo, & Davis, 2009).

An open-plan office is a shared room where upwards of four workstations are freely arranged in groups and where there may be short barriers between desks (Bodin-Danielsson & Bodin, 2008). Although some researchers have shown that co-locating employees in open-plan offices can help to foster collaborative organisational cultures (McElroy & Morrow, 2010), improve communication between employees (Allen, 1977), and make it easier for teams to achieve shared goals (Fahy, Easterby-Smith, & Lervik, 2013), others have demonstrated that open-plan offices undermine collegiality (Oldham & Brass, 1979; Oldham & Rotchford, 1983), cooperation (Kaarlela-Tuomaala, Helenius, Keskinen, & Hongisto, 2009) and potentially increase conflict (Connelly & Ayoko, 2013). These mixed empirical findings indicate a need to re-theorise the relationship between open-plan offices and collaboration by examining how the process of team collaboration unfolds in open-plan offices.

I focus on collaboration for two major reasons. First, organisations are increasingly adopting open-plan offices to promote teamwork, even though empirical research suggests that open-plan offices do not always have positive impacts on employee collaboration and communication (De Croon, Sluiter, Kuijer, & Frings-Dresen, 2005). Furthermore, as I demonstrate in Chapter 4, simply co-locating people in a shared open-plan office is not enough to ensure that employees will work together. Given these issues, Ashkanasy, Ayoko, and Jehn (2014: 1170) note that, “researchers and theorists need to go beyond merely providing evidence of the paradoxes and tensions associated with the physical work environment… [in order] to make a start on examining possible explanations, processes, and consequences underlying this paradox.” I respond to this call by going beyond existing research on individual outcomes (e.g. productivity, satisfaction), to explore the processes via which open-plan offices shape team collaboration.

Second, even where scholars have studied collaborative behaviours in open-plan offices, they have tended to conceptualise collaboration as an outcome (e.g. the amount of time spent
communicating, individual satisfaction with communication) and have not captured the content of communication (e.g. Boutellier, Ullman, Schreiber, & Naef, 2008; Hatch, 1993; Kim & de Dear, 2013). The focus on communication frequency is problematic, because as Ayoko and Härtel (2003) pointed out, open-plan offices often trigger conflict over limited space and resources. In this respect, more communication does not necessarily translate into improved team processes. Thus, rather than examining how collaboration has impacted on individual outcomes (e.g. Bodin-Danielsson & Bodin, 2008; De Croon et al., 2005) or asking whether open-plan offices lead to more or less collaboration (e.g. Boutellier et al., 2008; Hatch, 1993), I focus on how teams use open-plan offices to collaborate.

Given my focus, I conceptualise collaboration as a process, rather than as an outcome. Specifically, based on situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013), I view team collaboration as a form of situated cognition that takes place in particular social and physical contexts. In exploring situated cognition theory as it applies to teams, I depart slightly from Elsbach et al. (2005), who focus on the situated cognitions experienced by individuals that emerge from momentary interactions between contexts and schemas. Instead I draw inspiration from Cooke’s (2015) work on interactive team cognition, and her conceptualisation of team cognition as an emergent process that involves groups of people interacting with each other and with their physical surroundings to collectively process information and respond to dynamic situations. For example, the act of landing a plane on the back of a ship is only possible when the pilot, co-pilot, captain, and crew draw on their different expertise, attend to information displays on their equipment, and communicate with one another to share their different perceptions of the environment (Weick and Roberts, 1993). Cooke positions her work as a critique of theorists who focus on constructs such as Shared Mental Models (e.g. Mohammed, Ferzandi, & Hamilton, 2010) and Team Transactive Memory Systems (e.g. Ren & Argote, 2011), and who conceptualise team cognition as combination of schemas possessed by individual team members. In this regard, Cooke’s perspective resonates with situated cognition theorists such as Clark and Chalmers (1998), and Hutchins (1995), who describe cognition as something that takes place “out in the word”, rather than inside an individual’s brain. Thus, situation cognitions are not just something that individual experience, but can be observed in the interactions between team members in the context of their immediate physical surroundings.

In terms of understanding the relationship between open-plan offices and collaboration, I draw on Clark’s (1998) argument that physical objects can scaffold cognition by describing the open-plan office as a collaborative scaffold. Although not using the concept of a scaffold, other researchers have described how team members use physical objects, such as such as plans (Bechky, 2003), prototypes (Sutton & Hargadon, 1996), and PowerPoint presentations (Kaplan, 2010), to
make their individual thoughts accessible to other people. Stigliani and Ravasi (2012), for example, find that team members use post-it-note and pictures to help understand the relationship behind their individual ideas and to collectively generate designs for new products. Based on situated cognition theory, I choose to extend the metaphor of the scaffold to the physical work environment of the open-plan office. By describing the open-plan office as a collaborative scaffold, I capture the idea that open-plan offices facilitate particular behaviours and restrict others. Thus open-plan offices do not cause teams to collaborate, but rather provide a context within which collaboration unfolds.

To extend the boundaries of research about open-plan offices and team collaboration, my research centres on a key question: How do teams collaborate in open-plan offices? This question enables me to generate a theory of team collaboration in open-plan offices while also providing guidance to help managers better understand the trade-offs between the negative impacts of open-plan offices for individuals (e.g. distractions and interruptions leading to lower productivity and wellbeing) and potential positive impacts for teams (improved collaboration). I go beyond Ashkanasy et al.’s (2014) work on the potential negative aspects of team emotions and behaviours in open-plan offices, to outline the positive impacts that open-plan offices can have in terms of team collaboration. Next, I describe the theoretical assumptions that underpin this study, and the context, sample, and procedures for a comparative case study of seven teams from three organisations. I then discuss my findings in terms of my research question, and outline theoretical contributions, practical contributions, and implications for future research.

6.3 Methods

As scholars know little about team collaboration in open-plan offices, answering my research question required an inductive approach that allowed for the observation of multiple teams collaborating in context. In order to study the impact of physical context on behaviour, Hutchins (1995b) argues that researchers should go outside of laboratory contexts to study situated “cognition in the wild”. Furthermore, researchers should provide detailed descriptions of team members’ concrete actions in their physical context (e.g. Bechky, 2003a; Carlile, 2002; Fahy et al., 2013). I employed qualitative research methods, including semi-structured interviews, observation, and comparative case-study analysis. These techniques have been described as particularly suited to research on situated cognition, because they foreground the ways in which team members use their knowledge in practice with particular people and in particular physical settings. A comparative case-study approach allowed me to develop a deep understanding of the collaborations within each case, and to use comparisons to understand collaboration between cases (Eisenhardt, 1989).
6.3.1 **Context and sample**

The teams for this study were drawn from three different organisations across different industries and parts of Australia: a university located in a major Australian city, a resources company located in a regional Australian town, and an insurance company located in a major Australian city. The university was a leading Australian institution with a strong reputation for research that employed an equivalent of 6,800 full-time employees across 25 sites. The resource company was a top-20 ASX-listed company responsible for producing commodities including coal, copper, iron ore, and petroleum, and employed 128,800 people in 26 countries. The insurance company was a top-20 ASX-listed company incorporating brands in the insurance, banking, and superannuation sector, and which employed 14,500 employees in Australia and New Zealand.

The context for this study comprised seven teams working in open-plan offices. The teams provided a useful context within which to study collaboration because they occupied open-plan offices that varied in terms of size, whether desk space was allocated or flexible, and the level of personalisation permitted. The diverse sample of teams with different functions from different industries and in different open-plan offices was beneficial because it allowed me to identify commonalities in the opportunities and challenges facing different teams in different open-plan offices. The maximum variation sample allowed me to understand the common drivers of collaboration in open-plan offices, the different ways that open-plan offices can scaffold team collaboration, and the different conditions under which collaborative scaffolds impact on team performance.

Table 6.1 gives an overview of the seven teams I sampled from three different organisations. The two teams from the university were a Business Support Team and a Learning Improvement Team. The Business Support Team contained employees working in human relations, finance, communications, and administration roles that supported academic research. The Learning Improvement Team contained employees working in learning design, multimedia, animation, and project management roles, and was responsible for developing online academic courses. The two teams from the resource company were an Engineering Improvement Team and Engineering Project Team. Employees in the Engineering Improvement Team worked in process engineering, safety, and training roles, and were responsible for analysing and recommending improvements related to the movement of mined materials on- and off-site. The Engineering Project Team was made up of engineers from different sites who were working to improve the supply chain from mine to port. Finally, the three teams from the insurance company were a Business Improvement Team, a Business Compliance Team, and a Customer Compliance Team. The Business Improvement Team was responsible for improving business processes and managing change projects, the Business
Compliance Team was responsible for internal audits of the organisation, and the Customer Compliance Team conducted investigations to check whether or not customers’ insurance claims were legitimate and covered by their insurance policy. All teams worked out of open-plan offices and needed to collaborate with one another to achieve shared goals.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Description of offices</th>
<th>Team function</th>
<th>Team size</th>
<th>Approximate hours observed</th>
<th>Team members interviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td>University</td>
<td>- Small open-plan offices (4 to 9 desks) &lt;br&gt;- Extensive paperwork &lt;br&gt;- Allocated desks &lt;br&gt;- Extensive personalisation (photos, cartoons, office toys, information sheets, and draft work on walls and desks) &lt;br&gt;- Brainstorms and project schedules displayed on walls</td>
<td>Business Support</td>
<td>10</td>
<td>80</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Learning Improvement</td>
<td>9</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Resource Company</td>
<td>- Medium open-plan offices (10 to 24 desks) &lt;br&gt;- Clean desk policy (the surface of the desk must be cleared at the end of each day) &lt;br&gt;- Some hot-desking (employees have an allocated desk that may be used by others when they are not in the office) &lt;br&gt;- Minimal personalisation (a few photos and information sheets) &lt;br&gt;- Corporate posters on the wall</td>
<td>Engineering Improvement</td>
<td>21</td>
<td>80</td>
<td>6</td>
</tr>
<tr>
<td>Engineering Company</td>
<td></td>
<td>Engineering Project</td>
<td>Unknown</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Insurance Company</td>
<td>- Large open-plan offices (more than 25 desks) &lt;br&gt;- Almost paperless &lt;br&gt;- Hot-desking in neighbourhoods (employees do not have allocated desks, but can expect to sit in the same group of 10 to 30 desks each day) &lt;br&gt;- No personalisation (employees have a small tub to store personal items and paperwork) &lt;br&gt;- Corporate posters on the wall</td>
<td>Business Improvement</td>
<td>7</td>
<td>80</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Business Compliance</td>
<td>8</td>
<td>Observed adjacent team</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Customer Compliance</td>
<td>Unknown</td>
<td>Observed adjacent team</td>
<td>4</td>
</tr>
</tbody>
</table>

The members of the Business Support Team and the Learning Improvement Team from the university sat in small open-plan offices, containing desk space for six people and for nine people, respectively. Employees had been allocated desks and had extensively personalised their work areas. Group schedules and brainstorms were displayed on whiteboards and on the walls of the office. Employees stored paperwork on their desks, in their drawers, and in filing cabinets.
The members of the Engineering Improvement Team and the Engineering Project Team worked in medium-sized open-plan offices with desk-space for 15 people and 19 people, respectively. Employees had been allocated desks but stored only minimal objects in the office and displayed only corporate posters on the wall. Employees were expected to clear their desks at the end of each day so that other employees could use them when they were out of the office.

The members of the Business Improvement Team, the Business Compliance Team, and the Customer Compliance Team in the insurance company worked in large open-plan offices with desk space for 115 employees. Employees did not have an allocated desk and were not allowed to personalise their desks. Employees were provided with small plastic tubs in which to store personal items and were expected to pack these away at the end of each day.

I was a complete outsider and had no familiarity with the work being completed by the seven teams that participated in my research. Although the Business Support Team and Learning Improvement Team were located in the familiar environment of a university, I have no experience working in finance, human relations, learning design, or project management roles. Similarly, I had no previous familiarity with the work being completed by the Engineering Improvement Team, Engineering Project Team, Business Compliance, and Customer Compliance Team. I built rapport with participants by introducing my research and myself and by participating in social conversations, morning teas, and farewell parties. In all cases participants quickly got used to me observing them. When organisational members outside of the participating teams asked who I was, participants would generally say, “she is here observing us”, and I would explain my research was about open-plan offices. As with Study 1 and 2, in Study 3 I sampled participants with a range of perspectives on open-plan offices. I produced a number of different interpretations of my results until I came up with an interpretation that was convincing to both of my advisors.

6.3.2 Data collection

In comparative case-study research, Leonard-Barton (1990) recommends studying a small number of cases in detail and over time, and a larger number of cases in less detail using a cross-sectional sampling. Based on Leonard-Barton’s (1990) recommendations, I studied three teams in real-time through observations, and another four teams retrospectively using interviews. I adopted this approach because it allowed me to balance an in-depth understanding of how team collaboration unfolds in physical context, while also providing enough breadth to check that my findings applied to different types of teams. Although ideally observations would have been collected for all of the teams, resource constraints (i.e. the researcher’s time) made this impossible. Although I did not make formal observations of the Engineering Project Team and The Learning Improvement Team, I was provided with tours of the open-plan offices by a member of the
participating team, and spent some time in the offices when conducting interviews. Although there were also no formal observations made with the Business Compliance and Customer Compliance teams, they were located in the same office as the Business Improvement Team (a team that was studied in detail), so I was familiar with the office space where these teams worked.

I conducted semi-structured interviews with a sample of members from each team to capture the meaning that underpinned team members’ actions. I used interviews to gather background information about the team and its goals, and to identify key physical objects that team members used to coordinate, cooperate, and share information. Interview questions included, “how does your team co-ordinate to achieve its goal?”, “does your team use any physical objects to co-ordinate?”, and “how does the office space influence information sharing?” The semi-structured approach enabled team members to talk freely about their subjective impressions and opinions and to explain the research phenomena in their own terms, which is much harder to capture with more structured interview approaches that tend to impose the researcher’s understanding on the participants, and can limit the potential to develop new insights. I conducted interviews with at least three members of each team, and with the team leaders of the three focal teams. I interviewed multiple employees from each team to facilitate cross-checking of participants’ statements, and to ensure I understood the mechanisms for collaboration within each team. I was also able to capture some variation in the way that different team members coordinated, cooperated, and shared information with others in their team. I audio-recorded interviews, and they were transcribed by a professional transcriber.

During the observation phase, I spent approximately 251 hours in open-plan offices making notes about team member interactions. The observations resulted in 242 pages of typed field notes. Although researchers who undertake qualitative studies of teams have tended to collect data mainly during formal team meetings, I was interested in how the office space influenced informal and day-to-day interactions, within a team. As a result, I made observations across the whole workday. As there is no convention regarding the appropriate length of time to study a team, I chose to undertake two weeks of observation with each of the focal teams. This was enough time to build rapport with team members, and to get a sense of how the office space shaped collaboration in their team. I sat with each team and recorded written field notes about their interactions directly onto a laptop. I also attended team meetings, project meetings, morning teas, and a team vision workshop. In my notes, I included information about what team members were saying, where team members were sitting, standing, and moving, what body language team members were displaying, and what tools, technologies, and equipment team members were using.
6.3.3 Data analysis

To begin the data analysis, I first prepared summaries of each case based around the key themes in the interview questions. After becoming familiar with the raw data, I focused on inductively coding the data to generate new insights (refer to Figure 6.1). As per Strauss and Corbin’s (1990) recommendations, I read through the interview transcripts and observation notes, and assigned sections of text with a label that summarised their meaning. Based on the interviews, I generated open-codes such as, *individual roles, learning about content,* and *breakout rooms.* When creating open-codes generated from the observation data, I included the word “behaviour” in their label. Thus, open-codes generated from the observation data included: *manipulating virtual objects behaviour, adjusting behaviour,* and *cooperation behaviour.*

![Figure 6.1 Map of the inductive analysis process for Study 3, showing the movement from open-codes (e.g. chance interactions behaviour) to higher-order codes (e.g. interdependence), and to a summary statement (i.e. open-plan offices are one type of scaffold for team collaboration).](image)

During the second round of coding, I integrated the codes generated from the interview and observation data. I looked for similarities and differences between the open-codes, and grouped similar codes together under higher-order axial-codes. Axial-codes included *instant information-sharing, informal coordination, contextualised cooperation,* and *vicarious learning.* Through the
process of axial-coding, I was able to support my interpretations from both the interview and observation data.

In the third round of coding, I examined relationships between the first-order codes to develop higher-order themes, known as selective codes. At this stage of the analysis I returned to the literature to look for concepts that might help illuminate core categories. Situated cognition theory (Elsbach, Barr, & Hargadon, 2005; Semin & Smith, 2013) resonated with my findings. In particular, the concept of the physical environment as a scaffold for behaviour (Clark, 1998; Sun, Semin, & Smith, 2002) helped me to group axial-codes under the selective-codes of antecedents of collaboration, open-plan office as a collaborative scaffold, and alternative collaborative scaffolds.

The antecedents of collaboration code included factors that motivated the team to work together and which were independent of the open-plan office, namely interdependencies and collaborative norms. The open-plan office as a collaborative scaffold code incorporated specific ways that the open-plan office facilitated collaboration, including facilitating instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning. Finally, the alternative collaborative scaffolds code captured activities that employees used to collaborate that were not related to the open-plan office, such as using technologies or relying on formal meetings, roles, or routines.

6.4 Results

This section presents three key themes and nine sub-themes that answer Research Question 3: How do teams collaborate in open-plan offices? To begin, I describe the antecedents of collaboration in open-plan offices (interdependence and collaborative norms). Next, I examine four processes through which open-plan offices scaffold collaboration. Finally, I identify three situations under which the positive aspects of open-plan offices (i.e. collaborative scaffolds) are likely to outweigh the negatives (e.g. distractions, lack of privacy).

6.4.1 Antecedents of collaboration in open-plan offices

In order to explain how team members use open-plan offices to collaborate, I first outline the conditions under which open-plan offices facilitate collaboration. The findings of this study show that co-location alone is not enough to generate collaboration. Instead the observations and interview suggest that interdependence and collaborative norms are antecedents to collaboration in open-plan offices.

Antecedent 1, Interdependence: The level of interdependence required for the execution of day-to-day tasks differed across the teams in this study (i.e. task-interdependence). For example, the
The Business Improvement Team was highly task interdependent. This team sat in the corner of a large open-plan office (117 desks) alongside other teams. Based on the observation and interview data, team members relied on constant interactions to identify potential projects, prioritise projects, and allocate responsibilities. For example, one team member suggested, “we’ve all got different skills and we have to work closely together because they all cross over and we just need to keep learning” [Governance Officer, Business Improvement Team, I24]. The observation notes show that most of the team’s interactions involved cooperating (40% of all task-focused interactions in the open-plan office), or coordinating (48% of all task-focused interactions in the open-plan office). The interviews suggest that the team members’ reliance on others motivated them to use the open-plan office to collaborate. As one team member argued, “If I was sitting somewhere separately where I had to come out or make appointments, things would be a lot slower and I wouldn’t be able to complete the tasks right then and there” [Governance Officer, Business Improvement Team, I25].

In contrast, the Business Support Team, who sat in a small open-plan office with 6 desks, had low task-interdependence. Interview data show that team members had clearly defined roles (i.e. HR Officer, Finance Officer, and Administrative Officer) and rarely needed to interact to deliver administrative support. As one team member suggested, “we don’t really know what the other person does… we’re dependent on [other team members] knowing their own roles and meeting their deadlines” [Finance Officer, Business Support Team, I2]. The Business Support Team spent most of their interactions coordinating (53%) and a smaller proportion of interactions working together on shared tasks (32%). As in other teams with lower levels of task-interdependence (e.g. the Engineering Improvement Team and the Engineering Project Team), members of the Business Support team did not have any reason to constantly interact and collaborate with others in team. As the team’s manager suggested, “unfortunately we have three or four different types of activities happening in the one room, which is what has caused some issues in the past because they don’t naturally kind of work together as a team in terms of their theme of work” [Manager, Business Support Team, I5].

**Antecedent 2: Collaborative norms:** Alongside interdependencies, I found that collaborative norms were an antecedent of collaboration in open-plan offices. Collaborative norms emerged when team members had a shared understanding about appropriate behaviour in the open-plan office. The interviews indicated that teams had norms about noisy interactions in the office, the appropriateness of contributing to overheard discussions, and whether or not team members should introduce themselves to new people in the office. For example, team members in the Learning Improvement Team suggested that team members who needed quiet should move to one of five breakout spaces (three offices, a meeting room, and a board room). As one of the Learning Designers argued,
“people are really understanding—they know that when someone has got a lot on their plate that they might just stand up, pick up their laptop and head [to a breakout space]” [Learning Designer, Learning Improvement Team, I29].

Teams that did not have collaborative norms would sometimes struggle to overcome negative aspects of the open-plan office, such as distractions and interruptions, which damaged team relationships and made it difficult for team members to collaborate. For example, in the interviews members of the Business Support Team argued that in the past they had struggled to manage distractions and interruptions that created “that negative vibe within the room” [Human Relations Officer, Business Support Team, I1]. It was not until the team worked with a facilitator to develop a protocol for behaviour in the open-plan office that their interactions became less hostile and more collaborative. As their manager suggested, “the protocols that they developed with that consultant has, I think, given them the confidence to work together better [Manager, Business Support Team, I5]. Over time, team members suggested that they became more aware of each other’s idiosyncrasies and relied less on strict adherence to the protocol. Once the team members had established clear norms for working together in the open-plan office, they found it easier to adjust their behaviour to accommodate one another.

Overall the interview and observation data suggest that open-plan offices are only likely to promote collaboration when a team develops collaborative norms for how to work together. Although I did not investigate in detail how teams had developed behavioural norms for the open-plan office, members of the Business Improvement Team implied that they learned this in their normal team training, through team building activities and working together over time. Members of the Business Support Team, in contrast, suggested that their collaborative norms only developed after formal intervention and the establishment of a formal protocol, but that over time, these had become a normal part of the way they worked together as a team. The key learning is that simply co-locating people in an open-plan office is not enough to support collaboration. Instead managers or team members need to engage in activities to help team members develop collaborative norms.

6.4.2 **Collaborative behaviours scaffolded by the open-plan office**

Having shown that employees are likely to use open-plan offices to collaborate when they are interdependent and share collaborative norms, I now explain *how* teams collaborate in open-plan offices. Based on observations and interview data, open-plan offices scaffold the following behaviours: instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning. In this section, I describe each of these collaborative scaffolds.

*Scaffold 1, Instant information sharing:* The interview data reveal that members from every team suggested the open-plan office allowed them to engage in instant information-sharing. This
meant that team members could turn to each other and ask questions when a problem arose. As a Finance Officer from the Business Support Team suggested, “I think for me [the open-plan office] does help because you’ve got access to four or five other people’s brains and knowledge and you’re aware of what’s going on so you can help each other out” [Finance Officer, Business Support Team, I2]. My observation notes reveal an example of instant information retrieval in the Business Support Team. This example demonstrates how purposeful interactions in the open-plan office can enable team members to access information in the moment that they need it:

LD calls out from her desk “Hey SL. You know how we had notes in the old outlook?” LD gets up and goes over to SL’s desk to look at her computer screen. SL, responds, “Yeah, I’ll show you, it’s in a weird place”. SL shows LD where to find notes in outlook. LD returns to her desk.

In this instance, the open-plan office allowed LD to retrieve information from SL without needing to arrange a formal meeting.

Findings also show that team members used overhearing as a mechanism for sharing information. Overhearing conversations allowed team members to learn useful information, and could prompt them to volunteer information or an opinion. As a Governance Advisor from the Business Improvement Team suggested, “So, I might be having a conversation to [AL]… and then someone else will jump in and go, ‘Well actually, do you know this other area has been working on something similar like this. You might want to talk to them about and see how you can migrate their ideas into what you’re working on.’” [Governance Advisor, Business Improvement Team, I26]. Overall, the open-plan office supported instant information-sharing by allowing team members to overhear information and to easily engage others in interactions when they needed information.

**Scaffold 2, Informal coordination:** As well as information sharing, working in the open-plan office facilitated informal mechanisms for coordinating. Rather than relying on formal meetings for allocating tasks, the open-plan office enabled team members to discuss and allocate responsibility for certain tasks as they arose. A Finance Officer from the Business Support Team suggested, “we tend to be more impromptu or talk to each other more in that room because of the proximity” [Finance Officer, Business Support Team, I2]. Team members could catch up with one another at their desks and update each other on how they were progressing on certain tasks or projects, or would overhear information about how team members were progressing with certain tasks. A Learning Designer from the Learning Design Team described how the team scheduled bookings with the multimedia production officers to produce videos for their courses: “it’s almost like in passing and then other people can hear it too and then they’ll stand up and say ‘Oh I was going to book something tomorrow’” [Learning Designer, Learning Design Team, I28].
The open-plan office also meant that team members were aware of each other’s day-to-day interactions and activities. One of the Senior Engineers from the Engineering Improvement Team suggested that she was better able to keep track of her team after moving out of a private office into the open-plan because people came to talk to her more often. During an informal conversation she suggested that she liked sitting at the back of the office, facing the front door, because she could see the whole office and who was talking to each other about what project [Senior Engineer, O21]. This suggests that the open-plan office supports informal processes for coordination that enables team members to keep track of each other’s progress.

The open-plan office did not just scaffold informal coordination by facilitating face-to-face interaction, but by the arrangement and display of physical artefacts, such as whiteboards, planners, pin-up boards, post-it notes, information sheets, and computer screens. For example, the Learning Improvement Team used whiteboards to represent roles and deadlines visually (refer to Figure 6.2). A Learning Designer suggested, “we have a main whiteboard at the back that has a list of all of our names with all the courses that we’re attached to and approximate go-live dates, so that when [the director] comes back and decides he wants to assign you to a new course, he can at least look and see who’s really busy at what time” [Learning Designer, Learning Improvement Team, I30]. Furthermore, in the interviews, members of the Customer Compliance Team also explained how they used a whiteboard to display savings targets and other information. One of the investigations officers explained,

We also record things like our savings results up there, so we know where we are per month, because we have a little competition amongst ourselves, and also leave and things like that get written up on there or training, just so that we know where people are going to be all the time. [Investigation Officer, Customer Compliance Team, I19].

Thus, whiteboards facilitated coordination by providing easy-to-access, up-to-date team information. Overall, in the open-plan office, team members were able to synchronise their activities through informal interactions and shared physical artefacts.

*Scaffold 3, Contextualised cooperation:* As well as facilitating coordination, physical artefacts also helped employees to work together on shared tasks. Of the 740 task-related interactions recorded in the observation notes, 166 (20%) involved team members looking at, or manipulating, a common physical object such as a computer screen, a piece of paper, a printer, a whiteboard, a filing cabinet, or an organisational chart. For example, the open-plan office provided team members with easy access to others’ computer screens, so that they could help each other solve problems and progress tasks. An Analyst from the Engineering Project Team suggested, “So I guess there are times when I... show people my screen and just ask people for help on the spot” [Analyst, Engineering Project Team, I14]. Of the task-focused interactions that were recorded in the
observation notes, around 10% involved team members looking at, or referring to, information on their computer screen. As this example demonstrates, members of the Business Improvement Team often used their computer screens to cooperate on shared tasks:

EN, the new graduate, is helping SH to build an online contact list and is relying on SH to give her instructions. EN walks to SH’s desk and asks a question. SH shows EN her screen and explains, “So I’m thinking if you go through a lot of documents and see what the functionality of those phone numbers are”. On her screen SH shows EN some examples and says, “See if you search for this, then, click on the central contacts list”. SH then asks, “Do you want to start on that?” EN agrees and returns to her desk.

The open-plan office created an environment where it was very easy for team members to turn around or stand up to look at one another’s computer screens. By enabling team members to glance at each other’s computer screens, the open-plan office provided team members with easy access to the common information they needed to cooperate.

Alongside their computer screens, team members in the open-plan office often used shared whiteboards to cooperate. In the interviews, members of the Learning Improvement Team spoke about using their office wall for brainstorming and project tracking (refer to Figure 6.2). As a Project Manager suggested,

Basically most of the stuff we write on the walls [is] dates and who’s responsible for what… We also plot things…Someone will write, ‘this is the lifecycle’ and we will leave it there and we wait. We’ll have a couple of sleeps and someone will walk past and go, ‘You know, we forgot to add X, Y and Z’. It’s rare that we’ll take it off unless we need space. [Project Manager, Learning Improvement Team, I31]

The project manager also described how visitors to their open-plan office were fascinated by the writing, pictures, and diagrams scribbled all over their office walls. She suggested, “It’s our work, it shows people, visitors how we do our work… we are quite proud of it” [Project Manager, Learning
Improvement Team, I31]. Thus, having access to shared displays in the open-plan office facilitated cooperation within the team, but also made team processes visible to people outside of the team. For the Learning Improvement Team, who relied on other teams to provide them with work, cooperating effectively with people from outside the team was central to working together within the team.

Although I have emphasised how the open-plan office facilitated contextualised cooperation by providing team members with access to shared computer screens and whiteboards, the observation notes show that some teams created visual representations, brainstorms, plans and other visualisations outside of the open-plan office. For example, during the interviews, members of the Business Support Team spoke about pinning post-it notes on a meeting room wall to create a timeline for a report, and members of the Engineering Project Team used whiteboards in their meeting room to plan presentations and amend technical drawings. Furthermore, during the observations, members of the Engineering Improvement Team used whiteboards in their meeting room to share safety information. The key advantage of having the display in the open-plan office, rather than in a meeting room, was that the writing could remain on display as a visual representation that the whole team could see and elaborate on.

Scaffold 4, Vicarious learning: The final way that open-plan offices scaffolded collaboration was by making it easy for team members to learn from one another and about one another. Based on observation notes, learning in the open-plan office was often vicarious or informal, meaning that team members could learn by watching others work, or could teach one another new skills in response to a problem or need that arose during the working day. As a process engineer from the Engineering Project Team suggested, “I’m always interested in learning and understanding more, so open-plan I find works really well for me because a lot of questioning is happening, a lot of learning is going on”. [Process Engineer, Engineering Improvement Team, I12]. Team members could learn from one another in the open-plan office without having to plan formal workshops or attend formal training. An observation of informal learning in the Business Improvement Team illustrates this idea:

CS walks to the back of the open-plan office to talk to SL. As CS turns to walk out of the office, she catches JD’s eye. CS stops at JD’s desk to ask, “how are you?” JD responds, “I am working on that invoice for you!” JD mentions the recent changes to the electronic finance system, and this sparks CS’s interest. CS asks JD a question about the changes and JD elaborates. [O1]

Although CS came into the office to talk with SL, she was also able to learn something from JD, simply because SL and JD sat alongside each other in the open-plan office. By making interactions easier, the open-plan office promotes vicarious and informal learning.
The observation notes show that the open-plan office enabled employees to learn skills relating to the completion of tasks. A graduate engineer from the Engineering Improvement Team argued that the lack of barriers in the open-plan office made it easy for team members to train each other. He suggested,

I think it’s a very positive environment for knowledge sharing. For example, [LK] just came back from going out on site and liaising with some people from the maintenance department. As soon as he walked in he just said, “Hey [DN], come to my computer, I want to show you how… a good way to do this.” [Graduate Engineer, Engineering Improvement Team, I6]

The open-plan office also made team members’ work highly visible to those around them, and could provide opportunities for feedback. A learning designer from the Learning Improvement Team suggested that, compared to when she was teaching in the classroom, “I get feedback from [other team members] all of the time, but it’s much more public I guess what we do… I feel like they all know what I’m up to” [Learning Designer, Learning Improvement Team, I30]. Overall, the open-plan office scaffolded team members’ abilities to learn from one another and receive feedback to improve their skills.

Alongside developing team members’ skills, the open-plan office helped team members to learn about each other and to work together as a team. A human relations officer from the Business Support Team suggested, “being in that space, you probably learn about five other jobs, how to do five other jobs” [Human Relations Officer, Business Support Team, I1]. Just like learning content knowledge, the open-plan office helped employees to passively learn about the people around them without consciously trying. A governance officer argued that in the open-plan office, you are “learning different things without realising, without asking, because you’re just listening to other people, picking things up about what people are up to and who they are dealing with.” [Governance Officer, Business Improvement Team, I25]. Unlike in Study 2, in which many participants suggested overhearing was a negative because they did not want other people to hear their conversations, in this study, where employees worked as part of a team, almost all interviewees were positive about the potential for learning that arose from being able to overhear other team members in the open-plan office.
Table 6.2: Examples to illustrate collaborative scaffolds in the open-plan office based on my observations of three teams

<table>
<thead>
<tr>
<th>Scaffold</th>
<th>Business Support</th>
<th>Engineering Improvement</th>
<th>Business Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instant information sharing</td>
<td>LD calls out from her desk “Hey SL? You know how we had notes in the old outlook? LD gets up and goes over to SL’s desk to look at her computer screen. SL responds, “Yeah, I’ll show you, it’s in a weird place. SL shows LD where to find notes in outlook. LD returns to her desk. [O2]</td>
<td>JL is struggling to fill out a form on her computer, and stands up to ask LE, who sits in the desk in front of her. JL asks LE, “So I right click and then what?” LE responds, “It should say flash point”. Noticing JL’s confusion, LZ jumps up from her desk and says to JL, “I just heard what you were talking about. If you need a hand let me know”. LZ walks around behind JL’s desk and looks at the computer screen. LZ explains to JL where to input the data. [O14]</td>
<td>NK turns to walk out of the office, she catches JD’s eye. CS stops at her desk, looking at her computer screen. SL, responds, “Yeah, I’ll show you, it’s in a weird place”. SL shows LD where to find notes in outlook. LD returns to her desk. [O2]</td>
</tr>
<tr>
<td>Informal coordination</td>
<td>The team uses a small whiteboard near the entrance to the office to track “who is in”, by placing a small magnet in the “in” or “out” column next to their name. One afternoon as CR was leaving work, she came into the office to explain to MG that she would be away from the office tomorrow. CR adjusted the “who is in” board before leaving the office. [O6]</td>
<td>CL comes by RY’s desk to ask why a meeting has been moved. They chat. Then CL returns to her desk. Later RY calls out, “Bob requested the meeting change”. CL responds, “Are you going to leave it there?” RY stands up and walks over to CL. “I can push it back if they want?”. They chat and decide not to reschedule [O11].</td>
<td>VK stands up and calls out: “NK, since MT last emailed you the analysis, has he sent you anything else about that project?” NK replies, “No”. VK sits back down. A few seconds later VK calls out to NK (sounding sarcastic and a little annoyed), “MT hasn’t edited that document since the date of our last meeting.” [O22]</td>
</tr>
<tr>
<td>Contextualised cooperation</td>
<td>LD calls JD over to her desk to look at a reimbursement claim. JD stands behind LD, looking at her computer. JD explains, pointing at LD’s screen, “I attached this.” LD responds, “So that makes it confusing… So he split the bill?” JD responds, “Well, that’s not what he said to me. Did you want me to check with him?” There are a few more exchanges, as JD explains to LD what the claim is about. [O2]</td>
<td>The team meets daily at 8am in the meeting room next to the open-plan office. On the whiteboard there are twelve plastic sleeves, each containing a piece of paper with data on topics such as safety, actions linked to the organisation’s values, and environmental incidents. DN, a graduate engineer, who is running the team through the meeting by updating the whiteboard creates a common physical context that ensures team members are aware of the most up-to-date data. [O11]</td>
<td>EN, a graduate, is helping SH to build an online contact list. EN walks to SH’s desk to ask a question. SH shows EN her screen and explains, “So I’m thinking if you go through a lot of documents and see what the functionality of those phone numbers are”. On her screen SH shows EN some examples, “See if you search for this, then, click on the central contacts list”. SH asks, “Do you want to start on that?” EN returns to her desk. [O25]</td>
</tr>
<tr>
<td>Vicarious learning</td>
<td>CS turns to walk out of the office, she catches JD’s eye. CS stops at JD’s desk to ask, “how are you?” JD responds, “I am working on that invoice for you!” JD mentions the recent changes to the electronic finance system, and this sparks CS’s interest. CS asks JD a question about the changes and JD elaborates. [O1]</td>
<td>The team meets daily at 8am in the meeting room next to the open-plan office. On the whiteboard there are twelve plastic sleeves, each containing a piece of paper with data on topics such as safety, actions linked to the organisation’s values, and environmental incidents. DN, a graduate engineer, who is running the team through the meeting by updating the whiteboard creates a common physical context that ensures team members are aware of the most up-to-date data. [O11]</td>
<td>When EN needed help, SH was able to easily refer to her computer screen and explain the task to EN.</td>
</tr>
</tbody>
</table>

Although CS came into the office to see SL, she was also able to learn something from JD because SL and JD share an office. |
When team members knew more about each other’s skills, preferences and personalities, they found it easier to work together. In the interviews, team members suggested that being aware of their team members’ body language, particularly when they were feeling stressed, tired, or had deadlines looming, helped to preserve positive relationships in the team. For example, a project manager from the Learning Design Team suggested, “It’s really important that I can observe how people are working and interacting with each other, because then that assists me with how I interact with them and how far I can go in terms of my requests and demands” [Project Manager, Learning Design Team, I31]. Observation notes show that team members in the open-plan office occasionally lowered their voices, or moved their conversations away from the open-plan office, when they noticed their colleagues’ disapproving body language. Thus the open-plan office scaffolded learning by helping team members to see, hear, and interact with one another. This helped team members to develop knowledge about each other and to accommodate each other’s moods and deadlines.

6.4.3 Alternative collaborative scaffolds

The data reveals that teams who relied on informal collaboration benefited greatly from the collaborative scaffolds of the open-plan office, but teams who used roles and routines or virtual communication to collaborate tended to experience fewer benefits. I discuss these issues to show the circumstances under which the positive aspects of open-plan offices (i.e. collaborative scaffolds) are likely to outweigh the negatives (e.g. distractions, lack of privacy). Table 6.3 provides a summary of the importance of each open-plan office scaffold and each alternative scaffold for the collaborative processes of each team.

Teams who tended towards face-to-face, unscheduled interactions relied very heavily on the collaborative scaffolds provided by the open-plan office to meet their goals. For example, members of the Learning Improvement Team in particular suggested that they used discussions in the open-plan office to schedule activities and make decisions. As a team that had recently expanded from two to nine people, the Learning Improvement Team did not have well-established roles or procedures. The team was in a state of flux because online learning was a relatively new area, their workload was growing, new technologies were becoming available, and the environment for online learning was changing. As a result, team members benefited from the ability to be flexible with roles and responsibilities. The open-plan office enabled an informal style of collaboration, because when urgent tasks arose, all team members could quickly divert their efforts towards catching up on that task. As one of the Project Managers suggested, “having a small team in a space with everyone mucking in catches a lot of balls before they hit the ground” [Project Manager, Learning Improvement Team, I32].
<table>
<thead>
<tr>
<th>Instant information-sharing</th>
<th>Informal coordination</th>
<th>Contextualised cooperation</th>
<th>Vicarious learning</th>
<th>Roles/Routines</th>
<th>Technology</th>
<th>Impact of office on team collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Support</td>
<td>Rely moderately on being able to ask team members questions and get an instant response</td>
<td>Rely little on informal interactions to coordinate. Roles and routines more important</td>
<td>Rely little on having access to whiteboards and each other’s screens</td>
<td>Rely little on learning from/about one another because team members work in different roles</td>
<td>Rely heavily on roles (e.g. Finance Officer), routines (e.g. end of month reporting), and formal meetings to collaborate</td>
<td>Rely moderately on email to share information and an online calendar to schedule tasks</td>
</tr>
<tr>
<td>Learning Improvement</td>
<td>Rely heavily on overhearing and informal interactions to share information</td>
<td>Rely heavily on overhearing and informal interactions to track progress and allocate tasks</td>
<td>Rely heavily on learning from/about one another because the nature of the work is constantly changing and the team’s functions are expanding</td>
<td>Rely moderately on roles to collaborate because team members are constantly renegotiating roles as they develop new projects</td>
<td>Cannot rely on roles to collaborate because team members are constantly renegotiating roles as they develop new projects</td>
<td>Rely moderately on email and online calendars to share information and schedule tasks</td>
</tr>
<tr>
<td>Engineering Improvement</td>
<td>Rely moderately on being able to ask team members questions and get an instant response</td>
<td>Rely moderately on informal interactions to get updates on the progress of projects. Roles more important</td>
<td>Rely moderately on whiteboards and computer screens for sharing information and updating team members</td>
<td>Rely slightly on area of responsibility as defined by team leader</td>
<td>Rely moderately on email, phone calls and online calendars to share information and schedule tasks</td>
<td>Rely moderately on email, phone calls and online calendars to share information and schedule tasks</td>
</tr>
<tr>
<td>Engineering Project</td>
<td>Rely little on being able to ask team members questions and get an instant response</td>
<td>Rely little on informal interactions to get updates on the progress of projects. Project plan and meetings more important</td>
<td>Rely moderately on whiteboards, computer screens, technical plans and PowerPoint presentations</td>
<td>Rely moderately on learning from/about one another when team members from different sites come together</td>
<td>Rely heavily on roles, project plan and meetings to collaborate</td>
<td>Rely heavily on video conferencing, phone calls and emails to share information and schedule tasks</td>
</tr>
<tr>
<td>Business Improvement</td>
<td>Rely moderately on being able to ask team members questions and get an instant response</td>
<td>Rely moderately on informal interactions to get updates on the progress of projects. Also use technology</td>
<td>Rely little on physical artefacts as the team collaborates virtually as well as face-to-face</td>
<td>Rely moderately on learning from/about one another in the open-plan, but also learn through online chat</td>
<td>Cannot rely on roles to collaborate because team members are constantly renegotiating roles as they develop new projects</td>
<td>Rely heavily on online tools such as Loom and Microsoft Lync for communicating and representing team roles</td>
</tr>
<tr>
<td>Business Compliance</td>
<td>Rely moderately on being able to ask team members questions and get an instant response</td>
<td>Rely little on physical artefacts as team does a lot of virtual collaboration</td>
<td>Rely moderately on learning from/about one another in the open-plan, but also learn through online meetings</td>
<td>Rely heavily on allocation of tasks by the team leader, which depends on team members’ capacity and skills</td>
<td>Rely heavily on online tools such as Microsoft Lync and SharePoint for collaboration and task allocation</td>
<td>Rely heavily on online tools such as Microsoft Lync and SharePoint for collaboration and task allocation</td>
</tr>
<tr>
<td>Customer Compliance</td>
<td>Rely moderately on being able to ask team members questions and get an instant response</td>
<td>Rely little on informal interactions to coordinate. Manager tracks workloads and assigns tasks</td>
<td>Rely moderately on whiteboard showing progress towards savings targets</td>
<td>Rely heavily on random allocation of tasks by a computer program</td>
<td>Rely moderately on online tools such as Microsoft Lync and SharePoint for collaboration and task allocation</td>
<td>Rely moderately on online tools such as Microsoft Lync and SharePoint for collaboration and task allocation</td>
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Table 6.3 Impact of open-plan office and alternative collaborative scaffolds on team collaboration
Members of the Learning Improvement Team suggested that they could not easily understand the information on each other’s different projects, so they relied heavily on asking each other for specific information when needed. As a learning designer suggested, “I think I would find it frustrating not being able to get immediate answers off people—I even struggle sometimes if someone’s not there or they’re out to lunch and I need to ask them a question” [Learning Designer, Learning Improvement Team, I28]. Thus, the open-plan office significantly influenced the processes of teams who relied on informal mechanisms for collaboration. Although a reliance on informal collaboration had some risks (i.e. team members could become too reliant on interactions with one another to retrieve information, and could struggle to progress their work if all team members were not in the open-plan office), overall the collaborative scaffold of the open-plan office was helpful for a team that had to respond to a rapidly changing environment and a growing workload.

Alternative scaffold 1, Roles and routines: In contrast with teams that relied on informal collaboration, teams with defined roles, routines, and regular meetings tended to rely less on the open-plan office to scaffold collaboration. Based on the observations and interview data, where team members had defined roles and responsibilities, regular interaction was less important because team success relied on individuals executing their own roles. As a Finance Officer in the Business Support Team suggested, “I guess we all have our own deadlines and goals... I just know my own deadlines and goals [for] me, so I just make sure I meet them” [Finance Office, Business Support Team, I2]. The Business Support Team also relied on routines, such as quarterly reporting, to make sure work was completed on time. This meant that team members knew what they had to do and when, without frequent interactions with one another.

Based on observations and interviews, the Engineering Improvement Team also relied on defined roles and regular team meetings to coordinate. The team was split across two open-plan offices, so team members could not rely on informal communication in the open-plan office to collaborate. Based on an organisational chart, the work completed by the team was split into ten areas of responsibility (e.g. inflow, outflow, utilisation, product quality), and one to three team members were allocated responsibility for each area. The team also met in a meeting room every morning for a 10 minute “stand up”, to discuss safety issues, identify who was in the office, and recognise team members for noticeable accomplishments. They also had a longer team meeting every week to update each other on how particular projects were progressing. Although the Engineering Improvement Team and Business Support Team did engage in collaborative behaviours in the open-plan office, they relied more heavily on roles and routines to collaborate. Overall, teams with defined roles and routines benefited less from informal coordination, instant
information-sharing, contextualised cooperation and vicarious learning, when compared with teams that relied on informal collaboration.

**Alternative scaffold 2, Technology:** As an alternative to roles and routines, some teams relied on technologies to scaffold collaborative activities and achieve team goals. Rather than displaying the team’s schedules or ideas as a physical visual representation, teams could use virtual analogues of these representations to facilitate collaboration. The Business Improvement Team, for example, included a member who was located interstate. Furthermore, team members regularly worked from home. As a result, the team used a combination of face-to-face and virtual collaboration. Although team members often engaged in collaborative behaviour in the open-plan office, they were also able to achieve information sharing, coordination and collaboration through virtual scaffolds.

![Figure 6.3 Screenshot of the online Lino Board used by Business Improvement Team. N.B. Identifying information is covered to preserve participant anonymity.](image)

In terms of information sharing, the team used communication technology Microsoft Lync for group chats, conference calls, and to send each other documents. Team members set up the software to automatically let others know if they were on a call, in a meeting, away from their computer, or available. Thus when team members were working in different locations and could not see one another, they used the member’s status in Lync to decide whether or not it was a good time to interrupt. To coordinate, team members held twice-weekly online meetings through Lync, and
documented roles and responsibilities on an online whiteboard called the Lino Board (Refer to Figure 6.3). A governance officer described the Lino Board:

Each person will have a space within the Lino Board where they actually have cards allocated to themselves, or they can put cards there themselves of all the items of work that they’re working on, and each week we’ll actually get together and talk to that Lino Board and explain to the rest of the team in terms of what we’re working on” [Governance Officer, Business Improvement, Team 4, I26].

Finally, to cooperate, team members used Lync to share their screens virtually. This technology allowed two people in different locations to see and manipulate each other’s screens while talking to each other on the phone. A governance officer argued, “the biggest thing that’s been a lifesaver for everybody is the sharing screens… you can then see my screen and exactly what I’m doing and then I can give you control and you can then drive my screen” [Governance Officer, Business Improvement, Team 4, I25]. Thus, for the Business Improvement Team, collaboration could take place in the open-plan office or by using virtual tools.

Overall, the results show how the process of team collaboration unfolds in open-plan offices. Firstly, I provide evidence that interdependence and collaborative norms are key antecedents of collaboration in open-plan offices. Secondly, I identify the four collaborative behaviours that are scaffolded by open-plan offices: instant information-sharing, informal coordination, contextualised collaboration and vicarious learning. Finally I show that teams may use alternative scaffolds to facilitate collaboration (i.e. roles, routines, technologies), and that the open-plan office scaffolds may be most useful for teams that rely on informal collaboration.

6.5 Discussion

In order to untangle the mixed findings of research on open-plan offices, my research addressed the question, How do teams collaborate in open-plan offices? By drawing on situated cognition theory, and conceptualising the open-plan office as a collaborative scaffold, I have provided empirical support for the idea that open-plan offices facilitate four kinds of collaborative behaviours. Thus, my research makes theoretical and practical contributions to research on open-plan offices, the physical work environment, and collaboration.

6.5.1 Theoretical contributions

Firstly, this research contributes to the debate about whether or not open-plan offices undermine or support collaboration (Hua, Loftness, Heerwagen, & Powell, 2010; McElroy & Morrow, 2010), and provides an explanation for mixed empirical findings (De Croon et al., 2005; Elsbach & Pratt, 2007). Consistent with situated cognition theory (Semin & Smith, 2013), my
findings show that open-plan offices should not be conceptualised as causing or inhibiting collaboration. Instead, when elements of the social context (i.e. interdependence and collaborative norms) create incentives for employees to work together, they will use open-plan offices to collaborate. By presenting interdependence and collaborative norms as the main drivers of collaborative behaviours in open-plan offices, I show that team members use the open-plan office to collaborate when they have a reason to work with those around them.

Our findings answer Ashkanasy et al.’s (2014: 1174) call for researchers to explore “how different office configurations and levels of task interdependence and workflow may interact”. Broadly, my research supports Ashkanasy et al.’s contention that interdependence is an important driver of behaviour in open-plan offices. More specifically, I extend their work by showing that task interdependence, which requires continual interactions between team members (Gully et al., 2002), is more important than outcome interdependence (i.e. team members rely on one another to obtain a shared goal, reward or feedback) for team collaboration in open-plan offices. Although outcome interdependence creates an incentive for team members to share information in the open-plan office, I show that, unless team members get consistent benefit from overhearing each other’s conversations, they will likely perceive these conversations as distractions. Overall, my research suggests that teams are most likely to benefit from the collaborative behaviours scaffolded by the open-plan office when it is important for everyone in the team to have an accurate and up-to-date understanding of what other team members are doing.

In terms of norms, I support other research (Fayard & Weeks, 2007; Pepper, 2008; Värlander, 2012) which shows that norms shape interactions between employees in physical work environments. In contrast to existing research that has tended to frame norms as a negative type of social control, for example Värlander’s (2012) demonstration that employees in open-plan offices develop and police rules to minimise noise and distractions (see also Hirst, 2011), my research shows that norms can be a positive way for team members to balance individual work and team interactions. I found that when team members intentionally, as well as openly, talk about and agree on shared norms of behaviour, they are better able to overcome issues such as distractions and a lack of privacy. This is because it helps team members to feel more comfortable in politely asking others to be quiet, or moving their conversations to break out areas. Thus, it is only when team members develop collaborative norms that they will be able to minimize the negatives associated with open-plan offices (distractions, lack of privacy), and take advantage of opportunities for collaboration.

Secondly, I contribute to literature that links the physical work environment and behaviour. Fayard and Weeks (2007) argue that researchers have struggled to conceptualise the relationship between physical work environments without implying physical determinism (i.e. particular
physical features cause particular behaviours). In seeking to overcome this problem, Wilson et al. (2008) describe the difference between physical proximity, which is the objective distance between team members, and perceived proximity, which relates to how close team members feel, suggesting that the latter causes interaction. The key limitation of Wilson and colleagues’ argument is that it privileges employees’ perceptions of proximity over the actual physical opportunities and constraints presented by the physical work environment, and focuses on proximity over other elements of the physical context (i.e. barriers, layout, office size, access to whiteboards, computer screens etc.). I overcome these limitations by examining one type of physical work environment where employees are co-located (i.e. open-plan offices) and by demonstrating the particular forms of collaborative behaviour that are facilitated by that environment.

Specifically, consistent with situated cognition theory, my research provides empirical support for a conceptualisation of the open-plan office as a scaffold that enables teams to engage in certain forms of collaborative behaviour (e.g. waiting for a meeting to get feedback, versus getting instant feedback from a colleague in an open-plan office, versus getting instant feedback through a virtual tool from an expert located in another state). Thus, the open-plan office is one kind of physical context that allows teams to collaborate in particular ways (i.e. learning through overhearing), which are not possible in other physical contexts (e.g. cell offices with four walls and a door). Specifically, I identify four processes through which open-plan offices scaffold collaboration: instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning. By conceptualising open-plan offices as a collaborative scaffold, my research does not ask whether or not open-plan offices cause collaboration, but considers the kinds of employees who may benefit from the specific forms of collaboration made possible in open-plan offices.

Thus, third, this research contributes to the debate about trade-offs associated with physical work environments (Elsbach & Bechky, 2007; Elsbach & Pratt, 2007): in particular, whether or not the enhanced communication and collaboration in open-plan offices can counter the potential negative impacts on individual productivity, wellbeing, and work satisfaction. Kim and de Dear (2013) argue that any small improvement in employees’ satisfaction with collaboration in open-plan offices is far outweighed by the negative aspects associated with privacy and distractions. As one of the first empirical studies to examine team issues in open-plan offices, my findings show that when employees are interdependent and have collaborative norms, they consider the overall impact of distractions and lack of privacy to be minimal. This is because employees tend to perceive office noise as containing potentially valuable information, and interruptions as an opportunity to help their colleagues. Employees also have relationships that allow them to communicate openly about
office noise. Overall, my research suggests that in a team context, some of the negative impacts of open-plan offices on individual productivity may be neutralised.

My research also suggests that the collaborative scaffolds of the open-plan office may not be beneficial for every team. Instead, the findings indicate that teams who work in a dynamic environment, where team goals, tasks and roles need to be renegotiated regularly (e.g. Learning Improvement and Business Improvement Teams), may benefit more from the instant information-sharing and informal coordination made possible by open-plan offices than teams who work on well-defined tasks (Business Support Team). The possibilities for vicarious learning in open-plan offices also mean that teams with inexperienced members (e.g. a regular intake of graduates), or who have a high turnover, are likely to benefit from the collaborative scaffolds of the open-plan office. My findings, however, also show that teams may be able to use alternative scaffolds, such as roles and routines or technologies, to collaborate effectively, and that teams who rely too heavily on the informal communication made possible by open-plan offices run the risk of coordination problems arising from insufficient formal planning.

A final theoretical contribution of this research is to the literature on collaboration. Specifically, I demonstrate that collaboration is an activity that is situated in a physical context. In doing so, I contribute to research that demonstrates the importance of portable material artefacts for facilitating knowledge sharing (Bechky, 2003b; Carlile, 2002) and collective learning (Lave & Wenger, 1991). My research extends this body of work by showing that physical work environments (walls, furniture, barriers, layouts etc.), where physical artefacts are stored and displayed, are just as important for facilitating collaboration as the artefacts themselves. Specifically, I show that team members in open-plan offices can easily access shared whiteboards and computer screens, which enables them to solve problems quickly and develop shared understandings about team roles, responsibilities and progress. My research, however, also shows that the physical context of the office may be less important for collaboration in teams who have virtual analogues for physical objects (e.g. virtual whiteboards and the ability to share screenshots). Overall, and consistent with situated cognition theory, my research confirms that collaboration unfolds among individuals, in particular physical and social contexts.

6.5.2 **Practical contributions**

This research supports the idea that simply co-locating employees in open-plan offices is not enough to improve team processes. Unless collaborative norms are encouraged, team members are unlikely to feel comfortable engaging in the kind of open discussion and information sharing that supports collaboration. Furthermore, teams may be unable to manage distractions and issues around privacy unless they feel comfortable communicating with the people around them, and have access...
to breakout areas and technologies that allow them to move to a quiet space. All of this suggests that the open-plan office will not improve collaboration without the support of other initiatives. For example, workshops that develop an open-plan office protocol may be essential. These workshops may help team members learn how to work together, and agree on ways to manage distractions and privacy. Furthermore, in some cases the open-plan office may not support collaboration as effectively as developing formal roles and routines, or collaborating virtually.

When employees are interdependent, have collaborative norms, have formal mechanisms for collaboration, and have strategies in place to undertake individual focused work (i.e. access to break out areas, ability to work from home), the open-plan office is less likely to negatively affect individual productivity caused by distractions and a lack of privacy. If managers are willing to train teams to work together in open-plan offices, the cost savings of adopting open-plan layouts may be an appropriate trade-off. Managers, however, should factor in the cost of providing enough meeting spaces and break-out areas to accommodate employees, and the cost of implementing technologies that enable employees to use office space more flexibly (or work from home). The risk is that team members who are co-located in open-plan offices without appropriate access to support, technology and break-out spaces, may struggle to manage distractions and a lack of privacy, leading to reduced performance, conflict, and increased employee turnover (Ashkanasy et al., 2014).

6.5.3 Limitations and future research

Although this research makes several contributions to theory and practice, it does have some limitations. Firstly, I chose to use qualitative methods to focus on the process of team collaboration in open-plan offices, and to identify conditions under which teams are most likely to avoid the drawbacks of working in open-plan offices (i.e. distractions, lack of privacy). Thus, my research is limited in that I did not seek to understand the relationship between open-plan offices, collaboration and team outcomes. Future research should examine the conditions under which the collaborative scaffolds of the open-plan office are likely to support positive outcomes for teams (i.e. effectiveness and efficiency). Such research would be best conducted using survey-data collection methods and a large sample of teams (e.g. Kim & de Dear, 2013)

A second limitation of my research is that I only captured a few team types. Based on Hollenbeck et al.’s (2012) framework for describing teams, all of the teams sampled in this study were medium to high on temporal stability (ongoing or long-term project teams), medium to high on authority differentiation (traditional work teams with a formal supervisor), and medium to high on skill differentiation (included employees in different roles or with different levels of experience). Although the teams are typical of those who work in office environments, it would be interesting to know if teams that vary in these dimensions would benefit more or less from the collaborative
scaffolds in open-plan offices. For example, short-term teams with low authority differentiation might benefit more from the quick information retrieval and informal coordination style made possible in open-plan offices, because they need to meet goals in short timeframes without a clear leader to drive decision making.

A final limitation of this research is my focus on face-to-face interaction in teams, even though many team interactions took place virtually, through emails, online calls, and messaging software such as Microsoft Lync. It is clear that the rise of technologies that enable virtual work has emerged concurrently with new ways of using office spaces, such as hot-desking, activity-based working, and working from home. Thus, I support Gilson et al.’s (2014) call to more comprehensively understand issues related to space, place and mobility when it comes to virtual and co-located teams. In doing so, I urge researchers to go beyond simple conceptualisations of physical work environments as proximity, as my research shows that physical features such as break-out areas, office size (shared by more than one team) and the ability to display team roles and brainstorms on whiteboards, all contribute to collaboration.

6.6 Conclusions

In conclusion, this research makes several important contributions to theory and practice. Firstly, I contribute to research on physical work environments, by showing that the open-plan office may be a collaborative scaffold and by identifying four ways that open-plan offices might scaffold collaboration in teams. Additionally, the data demonstrate that the positive impacts of open-plan offices outweigh the negative impacts when employees are interdependent and develop collaborative norms. Thus, to ensure that open-plan offices are a positive environment for team collaboration, managers need to foster open communication; invest in training to help team members learn about each other’s beliefs, knowledge and preferences; and develop open-plan office protocols and norms to help team members overcome the negative issues of distraction and lack of privacy.
CHAPTER 7: DISCUSSION AND CONCLUSION

7.1 Introduction

In this concluding chapter, I draw together the key insights from the dissertation’s three empirical studies, and explain how the research questions have been addressed. I explain how the findings contribute to the existing literature on physical work environments, open-plan offices, collaboration, and situated cognition theory. I also highlight implications for practice. At the conclusion of the chapter, I discuss the limitations of the dissertation, and outline directions for future research.

7.2 Research issues

In Chapter 1, I present four limitations of the existing literature on physical work environments and collaboration. First, researchers have tried to understand whether or not open-plan offices facilitate communication-frequency and communication-ease (e.g. Boutellier et al., 2008; Sundstrom, Herbert, et al., 1982), but have not explored how employees use open-plan offices to collaborate. Second, existing research has not revealed a clear relationship between features of the physical work environment and collaborative behaviours. Instead, some researchers have found that open-plan offices promote collaborative behaviours, while others have found that open-plan offices hinder collaborative behaviours (De Croon et al., 2005). Third, scholars have typically studied open-plan offices that are occupied by employees who already know one another (e.g. Brennan et al., 2002; Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979. I am unaware of any research that has explicitly examined how new collaborative relationships form in open-plan offices. Finally, as Ashkanasy et al. (2014) argue, existing research on the physical work environment focuses on individual issues, rather than on team issues. I address each of these limitations with four research questions that I examine throughout this dissertation.

7.3 Synthesis of the research findings

In this section, I outline the four research questions that motivate this dissertation and explain how I have answered each question (refer to Table 7.1 for a summary). I explain the findings from the three studies, in terms of their relationship to each research question and the existing literature.


<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Findings</th>
<th>Chapter</th>
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| Overall RQ: What is the relationship between open-plan offices and collaboration?  | • The open-plan office is a collaborative scaffold that enables particular ways of collaborating (i.e. instant information retrieval, informal coordination, contextualised cooperation, and vicarious learning).  
• When employees have reasons to collaborate, they will use the open-plan office to collaborate.                                                                 | • Chapter 6                                  |
| RQ1: How do individuals develop new collaborative relationships in open-plan offices? | • Context-specific individual characteristics (e.g. career stage, personality, formal job role) shape employees’ intensions to collaborate with strangers in the open-plan office.  
• Personal encounters between strangers in open-plan offices involve both chance and intention (i.e. serendipity).  
• Individuals’ schemas (e.g. role-schemas, person schemas, norm-schemas) interact with social and physical contexts to shape interactions.  
• Personal encounters typically occur among employees who already know one another and have reasons to interact.  
• Around 90% of encounters in open-plan offices are purposeful rather than chance encounters.                                                                 | • Chapter 4                                  |
| RQ2: What are the conditions under which open-plan offices facilitate (and inhibit) collaboration? | • Social, organisational and physical contexts create barriers for collaboration, even when individuals want to collaborate.  
• Open-plan offices promote collaboration when employees want to work together, have shared understandings about how to behave in the open-plan office, and adjust their behaviour to accommodate each other’s needs.  
• Open-plan offices hinder collaboration when employees do not want to work together, do not discuss their different understandings about how to behave in the open-plan office, and do not feel comfortable communicating with each other.  
• Task interdependencies and collaborative norms are key drivers of collaboration in open-plan offices.                                                                 | • Chapter 4/5                                |
| RQ3: How do teams collaborate in open-plan offices?                                 | • Open-plan offices facilitate instant information retrieval, informal coordination, contextualised cooperation, and vicarious learning.  
• Open-plan offices’ collaborative scaffolds are more important for collaboration when team members do not use alternative collaborative scaffolds such as roles, routines, meetings, or technologies.                                                                 | • Chapter 6                                  |

### 7.3.1 Overall RQ: What is the relationship between open-plan offices and collaboration?

In the academic literature and in the media, there are three key ways in which the relationship between open-plan offices and collaboration have been presented. Advocates of the open-plan office have argued that open layouts support collaboration by creating a fun, egalitarian environment where employees are likely to experience chance encounters that spark new collaborative partnerships (e.g. McCoy & Evans, 2002; Zoller & Boutellier, 2013). Conversely, opponents of open-plan offices suggest that the link between open-plan offices and collaboration is a myth, and instead point to the negative aspects of distractions, noise, interruptions, lack of privacy and lack of control (e.g. Baldry & Barnes, 2012; Kim & de Dear, 2013). Finally, people who focus on open-plan offices as lean spaces with limited personalisation argue that office space has little...
impact on collaboration, because virtual interactions are more central to contemporary team work that face-to-face interactions (e.g. Hirst, 2011; Knight & Haslam, 2010; Warren, 2006). In terms of the academic literature, there is empirical support for all three perspectives on open-plan offices. These mixed findings motivated the overall aim of this dissertation, which is to understand the relationship between open-plan offices and collaboration.

My research transcends the categories of the fun, the cynical and the lean open-plan office by offering empirical evidence for an alternative account of the open-plan office as a scaffold for collaborative behaviour. In contrast to existing literature, where researchers have focused on whether or not open-plan offices facilitate collaboration, in this dissertation I outline the circumstances under which open-plan offices are likely to have positive, negative and neutral impacts on collaboration. In terms of the fun office, Study 3 shows support for the idea that open-plan offices can facilitate collaboration when employees are interdependent and share collaborative norms. Under these conditions, employees are able to develop strategies to overcome issues associated with distractions and a lack of privacy (e.g. meeting in break-out areas, taking phone calls outside of the open-plan office), and express very positive attitudes about working in the open-plan office. Thus, in Study 3, I challenge Kim and de Dear’s (2013) assertion that the potential positive impact on communication is outweighed by the negatives, by showing that employees in open-plan offices are likely to benefit from communication and suffer less from distractions and privacy issues when they share an office with members of their team.

In terms of the cynical view of the open-plan office, Study 2 outlines specific circumstances in which open-plan offices are associated with distractions and a lack of privacy. Employees in open-plan offices tend to experience negative impacts when they view their roles as requiring them to work on focused tasks (e.g. scientific writing) or confidential tasks (e.g. HR issues). This is because employees require privacy to concentrate and to feel comfortable in speaking openly and at length (see also Bernstein, 2012; Sundstrom, Herbert, et al., 1982). In this dissertation, I extend existing research by showing that an individual’s understanding of her or his role (i.e. role schema) shapes the individual’s experience of privacy issues in the open-plan office. For example, when scientists viewed collaboration as being central to their role (e.g. bouncing around ideas), and more so than managing sensitive relationships (e.g. with stakeholders and funding bodies), they tended to experience fewer problems associated with privacy.

In Study 2 I also found that open-plan offices are most likely to have negative impacts on individuals when the people who share the open-plan office have different roles and different expectations of behaviour. Thus, in this dissertation I challenge existing research that focuses only on individual characteristics to explain variations in employees’ responses to open-plan offices (e.g. Fried et al., 2001; Maher & von Hippel, 2005; McElroy & Morrow, 2010). Specifically, the
findings of Study 2 show that an employee’s response depends on the combination of individuals with different characteristics (e.g. sociability) and different roles (e.g. focused, collaborative) who share an open-plan office. Employees who share an office with people working in similar roles (e.g. all scientists, all administrative employees) tend to suffer less from distractions and privacy issues, because everyone in the office has a similar rule schema about the conditions that are conducive to working (e.g. noise or quiet). Conversely, in offices with a combination of very sociable and less-sociable employees, the employees who are very sociable often create distractions for those who are less-sociable.

In terms of the lean view of open-plan offices (e.g. Hirst, 2011; Knight & Haslam, 2010; Warren, 2006), the results presented in this dissertation show that there are some circumstances under which open-plan offices have little influence on collaboration. Specifically, in Study 3 I provide empirical support for the idea that open-plan offices may have little impact on team collaboration, if team members are familiar with collaborating virtually. Consistent with the literature on virtual teams, which shows that teams often combine face-to-face and virtual work (Gilson et al., 2014), Study 3 showed that the Business Improvement Team would often engage in virtual conversations, even when they were sitting next to one another in the open-plan office. Team members suggested that there was little difference between their collaborative process when everyone was in the office and when everyone was working from home. Thus, in this dissertation I show that although open-plan offices can facilitate collaborative processes under some circumstances, virtual technology may be just as effective under other circumstances.

In terms of making sense of the different circumstances under which open-plan offices support and hinder collaboration, this dissertation is one of the first examples of research to explicitly study collaboration, rather than related issues such as communication satisfaction, communication ease or communication frequency (for exceptions see Hua et al., 2010; McElroy & Morrow, 2010). Unlike existing research on open-plan offices, where collaboration has been conceptualised as an output, rather than as a process (e.g. Allen & Gerstberger, 1973; Boutellier et al., 2008; Brennan et al., 2002), I found that open-plan offices do not cause people to spend more or less time collaborating, but rather that the open-plan office supports, or scaffolds, particular types of collaboration. Specifically, in Study 3, I demonstrate that open-plan offices facilitate instant information-retrieval, informal coordination, contextualised cooperation, and vicarious learning.

By showing that the open-plan office is a scaffold for particular forms of collaborative behaviour, I resolve mixed findings on the relationship between open-plan offices and collaboration (De Croon et al., 2005). The findings of Study 1 and Study 2 show that employees who intend to collaborate will use open-plan offices to collaborate. Furthermore, in Study 3 I found that open-plan offices do not promote more or less collaboration, but facilitate particular ways of collaborating (i.e.
instant information-sharing, informal coordination, contextualised collaboration, and vicarious learning). By focusing on how teams use the open-plan office to collaborate, and the conditions under which open-plan offices promote collaboration, I provide a new theoretical lens for understanding the relationship between physical work environments and behaviour that does not imply a causal relationship. By drawing on situated cognition theory (Elsbach et al., 2005; Semin & Smith, 2013), I show empirically that collaboration in open-plan offices emerges from a combination of individual cognition, social context and physical context.

Although researchers who take an affordance perspective on the physical work environment (e.g. Fayard & Weeks, 2007; Värlander, 2012), have previously argued that physical work environments do not cause, but rather make possible, particular kinds of behaviour, they have not theorised the individual cognitive processes that underpin the relationships between environment and behaviour. Instead, Fayard and Weeks (2007) focus on affordances as arising from the interaction between individual perceptions and physical features, rather than examining what underpins those perceptions. By proposing situated cognition theory as an alternative to affordance theory, I found that individual schemas in the forms of intentions, role schemas, rule schemas and persona schemas, underpin the behavioural possibilities that employees are likely to act on and notice in an open-plan offices. In the dissertation as a whole, I demonstrate that employees will only engage in these forms of collaborative behaviours when they have individual reasons to collaborate, and when collaboration is supported by the social context (e.g. norms for collaboration).

7.3.2 RQ1: How do individuals develop new collaborative relationships in open-plan offices?

In terms of understanding the relationship between open-plan offices and behaviour, most existing research is focused on collaboration among people who already know each other (e.g. Brennan et al., 2002; Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979). For example, McElroy and Morrow (2010) followed workgroups as they moved from one office space to another, and Hatch (1987) compared the amount of collaboration that takes place between established workgroups. Thus, this dissertation is one of the first examples of empirical research to examine how open-plan offices shape the development of new collaborative relationships. In terms of existing research on collaboration in open-plan offices and in social networks, the dominant assumption is that chance encounters are the main way in which physical work environments shape interaction (Davis et al., 2011; Monge et al., 1985). From the chance encounter perspective, physical work environments that incorporate central kitchen areas, shared hallways, and open-plan layouts should generate chance encounters by facilitating the movement of people into shared spaces (Davis et al., 2011). By generating chance interactions between people who might not otherwise meet, physical work environments are supposed to generate collaboration, innovation and
organisational performance (Waber et al., 2014). In contrast to existing research, Study 1 demonstrates that shared physical work environments do not compel employees to interact. Instead, the physical work environment facilitates interactions only when employees intend to interact.

Specifically, in Study 1, I demonstrate that interactions in physical work environments involve an element of chance, but also an element of intention, because employees must notice and take up opportunities to engage in personal encounters. In contrast to previous research on collaborative behaviours in physical work environments (e.g. Boutellier et al., 2008; Hua et al., 2010; McElroy & Morrow, 2010), I conducted Study 1 in a building that was shared by people from different organisations, many of whom had no formal reason to interact with one another. Consistent with situated cognition theory (Semin & Smith, 2013), employees with intentions to collaborate tended to notice, and actively take up, opportunities to meet new people when they encountered mutual colleagues, attended events, or discovered commonalities with others in the building. Conversely, employees who did not intend to collaborate did not experience opportunities to interact with new people because they avoided shared areas, displayed closed body language, and/or socialised with their established colleagues only. Thus, in Study 1, I challenge existing research on the chance encounter, by showing that personal encounters come about as a result of both chance and intention.

Based on the results from Study 2, I also demonstrate that researchers have over-emphasised the importance of chance encounters in research on physical work environments. In support of Hirst (2011), who shows that employees who sit next to each other in an office do not necessarily introduce themselves or build collegial relationships, the findings from Study 2 reveal that people from different organisations could share an open-plan office without interacting with one another. Wilson et al. (2008) developed the concept of perceived proximity to argue that individuals can feel emotionally and cognitively close to colleagues at a physical distance (e.g. virtual teams), and emotionally and cognitively distant from people whom they sit next to at work. Yet, Wilson and colleagues provide little explanation as to how employees can avoid interacting with people they see every day in an open-plan office.

In Study 2, I explain why people who share an office avoid interacting, despite having regular opportunities to see and hear each other. The findings of Study 2 reveal that most interactions in the open-plan office occurred between people who already knew one another. Employees developed person schemas about other people in their office, and interacted almost exclusively with people they had formal working relationships with, or had met in another context. Consistent with situated cognition theory, individuals noticed and paid attention to stimuli (in this case, other people) that they believed would be relevant for future actions (Smith & Semin, 2007). In the context of a large open-plan office, employees focused their attention on people from their
own workgroup or organisation whom they knew they would have to work with in the future. Thus, employees tend to take up opportunities for chance encounters with people they already know, but ignore people with whom they do not have a personal relationship.

In Study 3, I provide some final evidence to show that researchers have over-emphasised the role of chance encounters in the link between physical work environments and collaboration. I found that almost all of the observed interactions between team members (90%) were purposeful rather than chance encounters (e.g. team members approaching their colleagues’ desks to ask a question, rather than encountering each other at the photocopier). This supports research by Zahn (1991), who demonstrates that chain-of-command distance and office distance jointly predict interaction. Together, Zahn’s research and the findings of this dissertation imply that employees purposefully seek out interactions with people whom they need to work with in a formal capacity. Overall, the findings from Studies 1, 2 and 3 point to employee intentions as one explanation for collaborative behaviours in open-plan offices, and suggest that employee intentions, rather than chance, explain most of the interactions in open-plan offices.

7.3.3 RQ2: What are the conditions under which open-plan offices facilitate (and inhibit) collaboration?

Researchers continue to debate whether open-plan offices support or inhibit interaction. Although Allen and Gerstberger (1973) argue that open-plan offices support collaboration because there are few barriers to inhibit interactions, other researchers suggest that open environments undermine collaboration because there is not enough privacy for lengthy and honest discussion. Empirical research is equivocal, with different studies finding evidence that open-plan offices support (Allen & Gerstberger, 1973; Boutellier et al., 2008; Brennan et al., 2002), inhibit (Hatch, 1987; Kaarlela-Tuomaala et al., 2009; Pepper, 2008) or have no influence (O’Neill, 1994) on collaboration. Although researchers have sought to explain these mixed findings, they have turned to physical explanations (e.g. Sundstrom, Herbert, et al., 1982), social explanations (e.g. Pepper, 2008), or individual explanations (e.g. Wilson et al., 2008). Thus, researchers have not simultaneously considered the interplay between individual, physical and social aspects to provide a holistic explanation for the conditions under which open-plan offices support and inhibit collaboration.

In this dissertation, I respond to this issue by drawing on situated cognition theory to provide evidence for the intertwined role of individual, social and physical context in shaping collaboration. In terms of explaining the conditions under which open-plan offices promote and inhibit collaboration, the findings of Study 2 show that open-plan offices promote collaboration when (1) employees are doing similar work, or are working as a team, (2) employees have similar
views of appropriate behaviour in the open-plan office, or are able to develop similar views through
discussions with each other, and (3) employees monitor others’ body language and adjust their
behaviours to accommodate others’ needs and preferences. Specifically, in Study 2 I challenge
existing research that has tended to look only at individual characteristics (e.g. personality, stimulus
screening ability) to explain why individuals have different experiences of the open-plan office (e.g.
Fried et al., 2001; Maher & von Hippel, 2005). Study 2 points to the importance of understanding
the composition of individuals in an office. For example, findings suggest that a sociable person
working in an open-plan office with other sociable people is likely to spend a lot more time
collaborating than the same individual working in an office where everyone else is less sociable.
Overall, when employees share an office with others who have similar personal characteristics (e.g.
sociability) and are working on similar tasks, they are better able to empathise with each other’s
needs (e.g. for a quiet or noisy space in which to work) and tend to find it easier to work together.

Finally, this in this dissertation I contribute to the literature on open-plan offices by focusing
on teams. Existing literature on open-plan offices has tended to focus on informal communication
(e.g. Davis et al., 2011; McCoy, 2005; Monge et al., 1985), and little attention has been given to the
formal structures (e.g. job roles, interdependencies) that shape how employees use open-plan
offices. Consistent with this limitation, McEvily et al. (2014) call for researchers to explore the
connections between the formal and informal elements of organisational life. In Study 3, I answer
this call by showing that a combination of formal structures (i.e. interdependencies) and informal
processes (i.e. collaborative norms) are key antecedents of collaboration in open-plan offices. These
findings support research by Ashkanasy et al. (2014), who point to the importance of task
interdependence in shaping employee behaviours in open-plan offices, and Fayard and Weeks
(2007), who argue for the importance of social norms as a link between the physical work
environment and social interactions.

Although existing research has shown that interdependencies (Ashkanasy et al., 2014) and
social norms (Fayard & Weeks, 2007; Pepper, 2008; Värlander, 2012) shape employee responses to
the open-plan office, the research behind this dissertation is the first to empirically demonstrate the
relationship between these variables and collaboration in open-plan offices. The findings of Study 3
point to the importance of formal processes, such as workshops, training, and mediation, to enable
teams to develop norms for collaborating in open-plan offices, while also demonstrating that norms
are maintained and developed though ongoing informal interactions between team members.
Overall, in Studies 2 and 3, I show that a combination of individual factors (schemas,
characteristics) and social factors (interdependencies, norms) shapes collaborative behaviours in the
physical context of the open-plan office.
RQ3: How do teams collaborate in open-plan offices?

Existing literature on open-plan offices has tended to emphasise individual issues, rather than team processes (Ashkanasy et al., 2014). Ashkanasy et al. (2014) have begun to explore the implications of open-plan offices for teams, through a conceptual paper that points to the role of affective events (specific situations that lead to emotional responses) in shaping collective identity, workflow and team behaviours in open-plan offices. In this dissertation I extend the work of Ashkanasy and colleagues by shifting the focus away from the emotional processes that underpin employee behaviour, towards the processes that underpin task work. Thus, the final research question addressed in this dissertation relates to how teams collaborate in open-plan offices. In Study 3, I answer this question through one of the first empirical studies to examine team issues in an open-plan office.

By addressing the process of collaboration in open-plan offices, I go beyond existing research that explores whether individuals in open-plan offices spend more or less time collaborating (e.g. Boutellier et al., 2008; Hatch, 1987), or feel more or less satisfied with collegial relationships (e.g. Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979). Instead, in Study 3, I challenge the assumption that the physical features of open-plan offices are consistently associated with particular behaviours, by identifying four collaborative processes that are facilitated in open-plan offices (Elsbach & Pratt, 2007). Thus, in Study 3, I challenge existing research on the link between open-plan offices and collaboration by showing that the open-plan office is a scaffold that facilitates four collaborative processes: instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning.

In terms of information sharing, existing research has pointed to the role of open-plan offices in facilitating the rapid exchange of information (Boutellier et al., 2008; Elsbach & Bechky, 2007; Heerwagen et al., 2004). Vischer (2006: 63), for example, has argued that the open-plan office promotes collaboration “through its effects on communication and the exchange of information”. Yet Värlander (2012) notes that spontaneous information-sharing may also create distractions for others, and thus may be moved out of the open-plan office and into closed meeting rooms. Consistent with Värlander, in Study 3, I found that although open-plan offices scaffold instant information-sharing, this does not necessarily mean that people will use open-plan offices to share information. Instead, the findings of Study 3 show that when teams have collaborative norms that support information sharing in the open-plan office, they are more likely to use the open-plan office to share information. In this study, I also found that team members in the open-plan office may engage in instant information-sharing through virtual tools, to maintain the confidentiality of the conversation and to avoid distracting others.
With regard to informal coordination, Boutellier et al. (2008) have demonstrated that employees in open-plan offices spend less time in formal meetings than those in cell offices, suggesting that open-plan offices facilitate a more informal approach to coordination. Consistent with these findings, in Study 3, I found that open-plan offices scaffold informal coordination. In Study 3, I extend the existing research by demonstrating the risks of relying too heavily on informal coordination. Although informal coordination has the potential to save time spent in meetings and allow teams to respond more quickly to changes that require the reallocation of resources (e.g. unexpected turnover of team members or increase in workload), it may also lead team members to neglect long-term planning and to prioritise unimportant tasks. Thus, unlike Boutellier and colleagues, who emphasise the positive aspects of informal collaboration in open-plan offices, in this dissertation I suggest that informal coordination comes with both benefits and risks.

Furthermore, with regard to coordination in open-plan offices, Fahy, Easterby-Smith and Lervik (2013: 142) have called for “the examination of devices that aid the distribution and coordination of actors and their relations in space and time”. They suggest, for example, that job descriptions that specify roles and responsibilities shape spatial and social boundaries between and within teams. In response to this call, the findings of Study 3 demonstrate that physical artefacts displayed in open-plan offices, such as “who-is-in” boards and whiteboards with project roles, can facilitate coordination by allowing team members to quickly get an up-to-the-minute sense of who is responsible for what and how tasks are progressing (see also Heerwagen et al., 2004). As with coordination, in Study 3 I show that teams may use virtual analogues of physical artefacts (e.g. online pin-up boards) to facilitate coordination.

With regard to cooperation in open-plan offices, Kaarlela-Tuomaala et al. (2009) demonstrated that the move from cell to open-plan offices resulted in a decline in employees’ perceptions of cooperation with their colleagues. Fahy et al. (2013), on the other hand, present cooperation as a trade-off. They show that moving members of a cross-functional team into a shared room improves cooperation among team members, but undermines cooperation between each team member and their functional area. In contrast to existing research that focuses exclusively on the face-to-face element of cooperation in open-plan offices (Fahy et al., 2013; Kaarlela-Tuomaala et al., 2009), the findings of Study 3 show that the arrangement of physical objects in an office can also shape cooperative behaviours. Specifically, open-plan offices provide team members with access to a common physical context. Team members use whiteboards in the open-plan office to brainstorm ideas and to help each other visualise problems. These visual representations are on display for all team members to see and elaborate upon. Furthermore, in Study 3 I found that much of the cooperative activity between team members occurs when they are looking at a shared computer screen.
Finally, in this dissertation I show how open-plan offices scaffold collaboration by facilitating vicarious learning. On the one hand, Bernstein (2012) argues that learning is enhanced in private, rather than in open work environments, because employees have the opportunity to solve problems for themselves and to explore new ideas without interference from managers, whose presence leads employees to comply with existing procedures. On the other hand, Edenius and Yaklef (2007) suggest that team members in open-plan offices tend to rely too heavily on informal learning because they can get help whenever they need it, and may fail to document this learning so that it can be used in the future. In terms of learning in open-plan offices, the findings of Study 3 contribute to this debate by providing empirical support for open spaces as facilitators of vicarious and informal learning, where employees are able to learn by watching others complete tasks, and through informally asking others to show them how to complete tasks.

Overall, I have answered four research questions through the three empirical studies in this dissertation. First, I challenge existing accounts of the relationship between open-plan offices and collaboration, by showing that the open-plan office is a scaffold for particular collaborative behaviours. Second, I have found that individuals develop new collaborative relationships in the open-plan office through serendipitous encounters. Third, I outline the individual and contextual conditions that explain why open-plan offices sometimes support and sometimes inhibit collaboration. Fourth, I identify four processes to explain how teams collaborate in open-plan offices: instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning.

7.4 Contributions to situated cognition theory

Situated cognition theory has rarely been applied within organisational behaviour, although other frameworks with similar assumptions, such as situated learning theory, transactive memory theory, and affordances theory, have been applied. In this dissertation, I extend Elsbach et al.’s (2005) conceptualisation of situated cognition as the interaction between schemas and contexts, by applying their interpretation of situated cognition theory to understanding collaborative behaviours in open-plan offices. Specifically, I have found that intentions, role schemas, rule schemas, and person schemas interact with physical context, social context, and embodied context to shape whether or not employees use open-plan offices to collaborate. In this dissertation, I go beyond the focus of Elsbach et al. (2005) on specific situated cognitions (e.g. problem understanding, collectivist mindset), by drawing on insights from situated cognition theory as described in social psychology and cognitive anthropology. Specifically, I make the assumption that cognition is for action, and focus specifically on how the interaction between schemas and contexts promotes collaborative action. Thus, this research is one of the first studies in organisational behaviour to use
situated cognition theory to provide a link between individuals (schemas), groups (social context), the physical work environment (physical context), and behaviour (action).

Second, in this dissertation I extend situated cognition theory by clarifying that physical work environments, such as open-plan offices, may be conceptualised as collaborative scaffolds. The findings of this research demonstrate that physical context may incorporate the arrangement of objects in a physical work environment, such as an open-plan office. Specifically, in this dissertation I found that the open-plan office can scaffold collective cognition and promote collaborative behaviour, by facilitating instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning. Thus, I extend situated cognition theory by showing that the arrangement of physical objects is just as important as the objects themselves when it comes to promoting individual and collective actions that lead to specific or desired outcomes.

7.5 Contributions to practice

In this dissertation, I make five main contributions to practice. First, I provide insight into how organisations might foster informal interaction among people who would not otherwise meet or interact. Given the complex nature of work, employees increasingly need to interact and work with people outside of their own work group or organisation, in order to innovate and to deliver project outcomes (DeChurch & Mesmer-Magnus, 2010). The findings of this dissertation suggest that the physical work environment will facilitate these interactions only when they are consistent with the intentions of the employees who use those environments. Thus, managers should not adopt shared spaces or open-plan offices in the hope of breaking down existing silos, because these efforts may be futile. Instead, managers must convince employees of the value of interacting outside their own existing work group (if this is indeed valuable) and provide spaces that facilitate these interactions.

To encourage employees to use their physical work environment to collaborate, managers should explain the benefits of collaboration to employees, model collaborative behaviour themselves, design interdependencies within and between work units that require employees to work together, and provide rewards to employees who collaborate. This means taking a holistic approach and understanding interaction as an activity that occurs when people want to interact, where there are strong norms for interaction, where there are formal reasons for interaction (e.g. interdependencies, shared projects, work roles), and where there is a mix of open and private spaces to facilitate different kinds of interaction.

The second practical contribution of this research is to provide guidance to managers on how to ensure that open-plan offices have positive rather than negative impacts on employees.
Firstly, managers should co-locate employees who do similar work (e.g. individual-focused work) or who need to work together. During the course of this research, I encountered numerous examples in which this simple principle was not adhered to: employees working in noisy call centres shared an office with programmers who required quiet concentration to do their work; human relations officers who engaged in frequent interactions were collocated with scientists who needed quiet space for individual work. When employees who do similar work share an open-plan office, they find it easier to empathise with the work requirements of other people.

Third, managers need to help employees learn about others’ roles, work styles, and preferences. Again, when people who share an open-plan office understand the environment that their colleagues find productive, they are better able to adjust their own working style to accommodate others. This can be achieved through a formal workshop where employees are supported to develop their own guidelines for behaviour in the open-plan office. Even if employees do not strictly adhere to the guidelines, the process of agreeing on broad rules of behaviour can foster trust and open-communication, so that employees feel comfortable raising their concerns with one another.

Fourth, managers should provide employees with appropriate spaces, technologies, and options (i.e. homeworking) for private work. In a noisy office, employees need access to private spaces for focused work, and in a quiet office employees need to access spaces for interactions and confidential conversations. Surprisingly, my research showed that managers sometimes incorporated breakout rooms into open-plan offices and encouraged employees to use these spaces for quiet work and phone calls, but only provided employees with desktop computers and desk phones. Additionally, employees needed to book breakout rooms in advance. This meant that employees could not spontaneously use breakout rooms when they received unplanned, private phone calls, or had to complete an unexpected task that required concentration. Furthermore, breakout rooms were sometimes converted into private office spaces, which meant that employees in the open-plan office could struggle to find a breakout room when they needed one. Some managers were also reluctant to let employees work from home, even when employees were able to demonstrate that this was an environment more conducive to individual work. Overall, managers need to understand how the physical office environment fits into the broader system of goals, processes, culture, people and technology in their organisations (e.g. Davis et al., 2011).

The final practical implication of this dissertation relates to whether or not the particular forms of collaborative behaviours scaffolded by the open-plan office actually have a positive impact on team processes and outcomes. Some researchers and practitioners claim that open-plan offices can foster informal interaction, facilitate collaboration, and lead to positive outcomes such as innovation, effectiveness and efficiency (McCoy & Evans, 2002; McElroy & Morrow, 2010;
Thanem et al., 2011; Waber et al., 2014). Although I did not explicitly examine the impact of open-plan offices on team outcomes, the implications of my findings are that open-plan offices will only contribute to positive team outcomes under a limited set of circumstances. The findings indicate that interdependent employees who are co-located in an open-plan office are able to nullify the potential negative impacts of distraction and a lack of privacy, by developing collaborative norms to manage these issues. Thus, for many teams, the open-plan office will have a neutral rather than a positive impact on team collaboration.

The findings of Study 3 indicate that certain teams may benefit more than others from instant information-sharing, informal coordination, contextual collaboration and vicarious learning. Firstly, teams that are working in a rapidly changing environment are likely to benefit from informal collaboration. For example, the Learning Development Team examined in Study 3 needed to constantly renegotiate roles and reprioritise projects as the size of the team increased and their workload expanded. Alternatively, when teams are working in stable environments, my research suggests that formal coordination mechanisms such as roles, routines and meetings are more important than informal coordination for ensuring team success. Thus, teams in stable environments are less likely to benefit from the collaborative scaffolds of the open-plan office.

Furthermore, teams with a high level of turnover, or with many inexperienced members, are likely to benefit from opportunities for vicarious learning that can take place in the open-plan office. For example, the Engineering Improvement Team that I examined in Study 3 included many graduate engineers who rotated through the team each year. Graduates could learn by watching senior engineers at work in the open-plan office, and by informally sharing their learning with each other. This saved time because senior team members did not have to facilitate formal workshops or training activities. Yet, teams with very experienced team members, such as the Business Compliance Team, did not benefit from vicarious learning because they already knew how to perform their roles. Instead, it was more helpful for them to learn from one another through formal “knowledge-sharing sessions” held at the end of each team meeting, or to participate in external training (e.g. workshops or post-graduate university qualifications).

Overall, the findings of this dissertation suggest that open-plan offices are most likely to have a positive impact on collaboration for teams that are working in rapidly changing environments or have inexperienced team members. This has implications for managers who are making decisions about (1) the construction of new office buildings, (2) the renovation of existing offices, or (3) the location of teams within an existing building. Managers should locate in open-plan offices teams that need to be flexible and are likely to experience high levels of change, growth or downsizing (e.g. a technology start-up). Alternatively, managers should be aware that stable teams of professional employees who work in clearly defined roles (e.g. a government department)
are likely to experience negligible benefits from working in open-plan offices, and may be better located in cell-offices or small shared offices.

7.6 Limitations

In this dissertation, I adopted a sampling approach that allowed me to generalise to theory (Polit & Beck, 2010), rather than to generalise about the population of employees working in open-plan offices. Specifically, by adopting a maximum variation sampling strategy to select cases and participants (Onwuegbuzie & Collins, 2007), I was able to examine a broad range of contexts where open-plan offices did and did not support collaboration. Based on my data, I found that open-plan offices support collaboration when employees who share an office are interdependent and share collaborative norms. Although these factors were key antecedents to collaboration among a range of teams in different open-plan offices, industries, and organisations, there is always a possibility that a different sample might reveal other contextual factors that alter the relationship between open-plan offices and collaboration. Furthermore, my sampling design did not allow me to explore how often the conditions that support collaboration in open-plan offices are actually present in organisations. In practice, it may be the case that very few organisations will benefit from collaboration in open-plan offices, because few organisations actually use teams that are highly task interdependent and who share collaborative norms.

A second limitation of this research is that I compare between employees in open-plan offices, rather than between employees in open-plan offices and employees in other types of offices (e.g. cell, activity-based). I decided to focus on understanding the differences between employees in open-plan offices, because there is great variation between different types of open-plan offices (e.g. size, allocated seating, and function) (Bodin-Danielsson & Bodin, 2008), and because open-plan offices seemed to support collaboration in some contexts and not in others (e.g. De Croon et al., 2005). Furthermore, researchers have already made comparisons between open-plan offices and other types of offices, particularly cell offices (e.g. Hatch, 1987; Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979), without first seeking to understand each type of office on its own terms. Nevertheless, my decision to focus only on open-plan offices means that I cannot make claims about whether or not open-plan offices are more likely to foster collaboration than cell offices. I also cannot say whether the collaborative scaffolds of the open-plan office are only supported in open-plan offices, or whether they may also be achieved in other kinds of offices. For example, it may be possible for employees in cell offices to experience instant information-sharing, informal coordination, contextualised cooperation, and vicarious learning, if employees spend time in each other’s offices, leave their doors open, collaborate virtually, or regularly spend time outside of their office in hallways or shared kitchen areas.
A third limitation of this dissertation is that I do not explore the relationship between open-plan offices and outcomes. I chose to examine the process of collaboration as it unfolded in open-plan offices, because most existing research (e.g. Boutellier et al., 2008; Hatch, 1987; Kim & de Dear, 2013) focuses on communication frequency or satisfaction as an outcome variable, and gives little attention to the content or context of the communication. As a result, scholars know little about whether open-plan offices support the kind of communication that is conducive to collaboration, or simply foster social discussions, gossip, or conflict. By focusing on process, however, I make no attempt to link collaboration to individual or team outcomes, such as creativity, innovation, efficiency, or effectiveness. Consequently, I cannot say whether or not the teams that used the open-plan offices to collaborate actually produced positive outcomes as a result of their collaborations.

A final limitation of this research is that I gathered the data for each case over a period of two or three weeks, even though workgroups and teams may work together in open-plan offices for months and years. This timeframe was appropriate for capturing the day-to-day collaborative behaviours that unfolded in open-plan offices. Yet my research showed that conditions in open-plan offices can change considerably over time, as workloads, personnel and other factors change. For example, team members from the Business Support Team, examined in Study 3, worked in relative harmony at the time of the study, but explained that their open-plan office had previously been an uncomfortable environment because of personality clashes between team members. As I did not follow workgroups and teams over the long term, I was only able to capture individuals’ retrospective accounts of changing patterns of collaboration in the open-plan office. Without gathering data over periods of months or weeks, it is difficult to show how antecedents of collaboration, such as collaborative norms and workflow interdependencies, might emerge and change over time.

### 7.7 Future research

Given the limitations of the current research, I make three suggestions for possible areas to investigate in the future. First, researchers may examine the types of collaborative behaviours afforded in a range of office environments, for example, cell offices or activity-based offices. The findings would enable researchers to make comparisons between different types of offices, and to provide practical guidance on what kind of office layouts will support the collaborative requirements of different workgroups and teams. To study the collaborative behaviours afforded by different types of offices, researchers could adopt a comparative case-study method, similar to the one that I adopted in this dissertation (see Eisenhardt, 1989). This would involve a researcher making direct observations of different teams in different types of offices, and using inductive
analysis (e.g. Strauss & Corbin, 1990) to identify the collaborative scaffolds that are unique to each office.

Alternatively, to capture the relationship between different types of offices and collaboration, researchers could follow a number of teams as they move from one type of office environment (e.g. open-plan office) to another (e.g. activity-based office). Researchers could then observe whether or not patterns of collaborative behaviour among team members change after the move. As with the many quantitative studies of teams moving from one office to another (e.g. Brennan et al., 2002; Kaarlela-Tuomaala et al., 2009; Oldham & Brass, 1979), the advantage of this research design is that any change in collaborative behaviour is likely to be linked to the office space. Furthermore, in an in-depth qualitative study, researchers would be able to observe and account for other factors, besides the office environment, that may be related to changes in collaborative behaviour (e.g. change in team goals, turnover in the team, development of open-plan office protocol following the move to a new office). Once researchers have a better idea about the collaborative behaviours that are scaffolded in different types of offices, it will be possible to select office spaces that will support positive outcomes for different types of teams (e.g. teams that are more or less interdependent, working in more or less uncertain environments).

Thus, a second area of potential future research involves exploring the impact of open-plan offices on team outcomes. Specifically, researchers could examine whether or not teams that use the collaborative behaviours scaffolded by open-plan office also experience improvements in their efficiency and effectiveness. The findings of Study 3 suggest that different teams experience different benefits from the collaborative scaffolds of instant information-retrieval, informal coordination, contextualised cooperation, and vicarious learning. For example, teams that experienced high levels of turnover (e.g. the Engineering Improvement Team, which had new graduates each year), or uncertainty (e.g. the Learning Improvement Team, who were continually revising the purpose and scope of their work) seemed to benefit from vicarious learning and informal cooperation. Conversely, teams with well-defined roles (e.g. the Business Support Team, which had employees in designated human relations, finance and administrative roles) seemed to experience fewer benefits from sharing an open-plan office because team members did not need to regularly share information or coordinate in order to complete day-to-day tasks. Thus, future research could examine the relationship between particular team attributes, particular collaborative scaffolds, and particular team outcomes.

One of the best ways to explore the relationship between open-plan offices and outcomes would be to use quantitative, survey-based methods. As Silverman (2005) has argued, quantitative research is the best way to examine relationships between inputs (e.g. office type) and outputs (e.g. efficiency, effectiveness, and innovation). One possible way to examine the relationship between
open-plan offices and team outcomes would be to conduct a quantitative field study of teams working in open-plan offices. Researchers could measure variables related to the team (e.g. collaborative behaviours, task interdependence, collaborative norms, average tenure of team members) by surveying team members. Researchers could measure team outcomes (e.g. innovation, effectiveness, or efficiency) by examining key performance indicators generated by the organisation, or by surveying team managers. This research would allow researchers to identify the teams that are likely to experience the greatest benefits from working in open-plan offices.

In order to understand how the collaborative scaffolds of open-plan offices lead to particular team outcomes, researchers would need to follow teams over the long term. Thus, a third area for potential research would be to examine how open-plan offices shape team processes and outcomes over a period of months and years. By taking a long-term view of open-plan offices, researchers could better understand the circumstances under which open-plan offices promote conflict, how collaboration is linked to the attainment of team goals, and how team members develop, maintain, or change collaborative norms. When it comes to collaborative norms, there is the potential for researchers to theorise social norms as situated in particular physical contexts. As Kärrholm (2007) argues, social norms are inherently tied to physical environments. He suggests, “Statements such as, ‘You cannot behave like that,’ often imply a tacit specification: ‘at this place’” (Kärrholm, 2007: 443). Fleming and Spicer (2004), for example, show that space can be used as a tool to bring behaviours not usually associated with the sphere of work (e.g. fun, partying, sexuality) into the workspace.

Thus, future research could examine the processes by which particular physical work environments become associated with particular norms, and how this may change over time. Such research could compare the behaviours exhibited by groups that have or do not have formal open-plan office protocols. Researchers could explore issues associated with the development of social norms in open-plan offices through in-depth qualitative observations in a small number of open-plan offices over time. This would involve repeated visits to the open-plan office to record field notes. Alternatively, researchers could use a repeated survey design. This would involve surveying employees every few months and then analysing the data in order to examine trends over time.

7.8 Conclusions

In conclusion, in this dissertation I provide a new way of understanding the relationship between open-plan offices and collaboration, by showing that the open-plan office is a scaffold for collaboration. The central aim of this dissertation is to understand the relationship between open-plan offices and collaboration. In particular, I seek to answer three research questions: How do individuals develop new collaborative relationships in open-plan offices? What are the conditions
under which open-plan offices facilitate (and inhibit) collaboration? And how do teams collaborate in open plan offices? The research questions are answered by three qualitative studies.

Study 1 is a single case study of a collaborative science building. Unlike existing research that focuses on chance encounters as the link between open-plan offices and collaboration, the findings of Study 1 indicate that employees develop new collaborative relationships through serendipitous encounters. Serendipitous encounters involve elements of both chance and intention.

Study 2 is a comparative case study of eight groups of employees in eight open-plan offices. This study resolves mixed findings on the relationship between open-plan offices and collaboration by outlining the conditions under which open-plan offices support and inhibit collaboration. Specifically, the findings of Study 2 show that an open-plan office will facilitate collaboration when the majority of people in that office have role schemas, rule schemas and person schemas that are consistent with collaboration.

Finally, Study 3 is a comparative case study of seven teams from three organisations that were located in open-plan offices. Study 3 is one of the first empirical studies of team behaviour in open-plan offices. In contrast to existing research that focuses on how much people collaborate, this research identifies four types of collaborative behaviour that are scaffolded by open-plan offices: instant information-retrieval, informal coordination, contextualised cooperation, and vicarious learning.

Overall, this dissertation shows support for the application of situated cognition theory for understanding the relationship between open-plan offices and collaboration. I found that collaboration is brought about by a combination of individual, social and physical factors. In Study 1, I found that an individual’s intention to collaborate can emerge from personal characteristics, such as sociability, career stage, and formal role. In Study 2, I found that intentions to collaborate are associated with an individual’s role, rule and person schema. In Study 3, I found that intentions to collaborate can emerge from team characteristics, such as interdependence and collaborative norms because these conditions provide incentives for team members to work with others in their open-plan office.

Overall, based on situated cognition theory, I provide evidence to support the idea of the open-plan office as a scaffold for collaborative behaviour. Specifically, collaborative behaviour arises from the interaction between individual schemas (e.g. intentions, roles, rules, and person) and contextual factors (e.g. work group, team, physical work environment, open-plan office).

In terms of practical implications, this research provides evidence that co-locating employees in a shared physical work environment, such as a collaborative building or open-plan office, will do little to foster collaboration on its own. Yet, when employees intend to work together and have reasons for doing so, open-plan offices can make it easier to engage in particular forms of collaborative behaviour. Future research could qualitatively explore the types of collaborative
behaviours that are scaffolded in other kinds of office environments (e.g. cell offices, activity-based offices), and quantitatively examine the relationship between open-plan offices and team outcomes.


NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 10, 2012.


APPENDIX 1: GLOSSARY

Some of the key terms in this dissertation can be interpreted in multiple ways. Thus, for the purposes of this dissertation the following definitions are provided. These terms are ordered alphabetically.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Case study</td>
<td>A detailed exploration of a research phenomenon, in its physical and social context, where there the context and the phenomenon are not separate from one another (Yin, 1994).</td>
</tr>
<tr>
<td>Cell office</td>
<td>An individual room with four walls and a door that is occupied by one individual (Bodin-Danielsson &amp; Bodin, 2008).</td>
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<tr>
<td>Collaboration</td>
<td>The behaviours of cooperation, coordination and information sharing (Rousseau et al., 2006).</td>
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<tr>
<td>Collaborative scaffold</td>
<td>The way that a physical work environment facilitates, or supports interactions between individuals that enables them to collaborate (e.g. Nicolini, Mengis, &amp; Swan, 2012).</td>
</tr>
<tr>
<td>Context</td>
<td>Opportunities and constrains that are specific to a particular situation, that shape the occurrence and meaning of behaviour in organisations and that shape the relationship between concepts (Johns, 2006).</td>
</tr>
<tr>
<td>Multiple case study</td>
<td>A case study that incorporates two or more cases where the focus is on comparing between cases and replicating findings across cases (Yin, 1994).</td>
</tr>
<tr>
<td>Open-plan office</td>
<td>A shared room where workstations are arranged in groups and where facilities such as photocopier and printers are shared (Bodin-Danielsson &amp; Bodin, 2008). There may be some barriers or partitions between work stations, but these will typically be 1-2 meters height and 1-2 meters wide. Open-plan office may vary in size from small (4-9 people), medium (10-24 people) to large (greater than 24 people).</td>
</tr>
<tr>
<td>Physical work environment</td>
<td>All of the physical objects in organisations including buildings, furnishings, equipment, ambient conditions, as well as their arrangement, for example open-plan offices, flexible team spaces and factory layouts (Elsbach &amp; Pratt, 2007).</td>
</tr>
<tr>
<td>Physical objects</td>
<td>Tangible tools, technologies and equipment that can be used to store knowledge and facilitate individual and collective action (Bechky, 2008).</td>
</tr>
<tr>
<td>Scaffold</td>
<td>The way that a physical work environment facilitates, or supports particular cognitions or behaviours. For example, a calculator scaffolds the cognitive process of calculation.</td>
</tr>
<tr>
<td>Schema</td>
<td>A simplified mental representations or model, that contains knowledge about ourselves, other people, objects, and events, which allow us to make sense of the world in conditions of limited information (Walsh, 1995). Schemas develop over our lifetime through learning, and are relatively stable unless we are confronted with overwhelming evidence that they are inaccurate (Elsbach et al., 2005).</td>
</tr>
<tr>
<td>Single case study</td>
<td>A case study that incorporates one case, which is usually a critical case (if it is true/false for this case it is true/false for all other cases), an extreme case (a rare case that provides a particularly rich setting for examining the phenomena), a typical case (a case that is representative of other cases), a revelatory case (a case where the researcher has unprecedented access to the phenomena) or a longitudinal case (a study of the same case at two or more points in time) (Yin, 1994).</td>
</tr>
<tr>
<td>Situated cognition theory</td>
<td>The relationship between cognitive schemas (e.g. rule schemas, event schemas, person schemas) and organisational context (e.g. physical contexts, institutional contexts) (Elsbach et al., 2005). I follow the definition of situated cognition theory as described in organisational behaviour (Elsbach et al., 2005) and psychology (Semin &amp; Smith, 2013) rather than philosophy (Clark &amp; Chalmers, 1998), and cognitive anthropology (Hutchins, 1995).</td>
</tr>
</tbody>
</table>
APPENDIX 2: STUDY 1 AND 2 EXAMPLE FLOOR PLAN

The collaborative science building included a total of 20 open-plan offices (two open-plan offices on the ground floor, and six open-plan offices on levels 1, 2 and 3). This floor plan shows two of the open-plan offices, which are separated by a shared kitchen area, stairwell and meeting spaces (shown in purple). The colours indicate the workgroups that are allocated to each space. The office to the left (shown in pink) is occupied by employees from one workgroup. The office to the right is occupied by employees from three workgroups (pink, orange and green).

Figure A.1 Example floor plan of two open-plan offices in the Collaborative Science Building
APPENDIX 3: STUDY 1 AND 2 INTERVIEW GUIDE

Version 1: Interviews 1-15

1. Tell me about your role
2. Where did you work previously?
3. What has your experience been working in this building? Positives? Negatives?
4. Where do you work? What is your work area?
5. What were your first impressions of the building? How do you feel now?
6. What has your experience been of the location of the building?
7. What has your experience been of the open plan office? Positives? Negatives?
8. How does it help you do your job? How does it make your job more difficult?
9. Do you have any coping strategies for dealing with the negative aspects of open-plan offices?

Version 2: Interviews 16-40

1. Tell me about your role
2. Where have you worked previously?
3. How do you feel about working in an open-plan office?
4. Are there things you do differently working in open plan compared to other office types?
5. How does it help you do your job? How does it make your job more difficult?
6. How do you cope with some of the negative things?
7. Are there any formal or informal rules about how to behave in the open plan office? What happens if people break these rules?
8. What has your experience been working in the building as a whole? Positives? Negatives?
9. Have you collaborated with new people since moving to the building?
10. What has your experience been of the location of the building?
APPENDIX 4: STUDY 3 FLOOR PLANS

Figure A.2 The Business Support Team was located in a small open-plan office, shown in red. The Finance Manager and Business Support Team Manager were located in cell offices, shown in blue.

Figure A.3 The Learning Improvement Team was located in a small open-plan office, shown in red. The manager was located in a cell office, shown in blue.
Figure A.4 The Engineering Improvement Team serviced two sites. Team members had an allocated desk space at one site and hot-desked at the other site. The team sat in two medium open-plan offices, shown in red. The manager had a cell office at each site, shown in blue.

Figure A.5 The Business Improvement Team (1), Business Compliance Team (2) and Customer Compliance Team (3) shared a large open-plan office. Desk spaces were allocated to teams, not to individuals. Team members could sit in any desk within their team’s area. Managers also sat in the open-plan office and did not have allocated desks.
APPENDIX 5: STUDY 3 INTERVIEW GUIDE

Background
1. Can you tell me a little bit about your role?
2. What is your team’s purpose? What is your team trying to achieve? What function does your team have?
3. How closely do you work with team members? What team members do you rely on to get your own work done? What do you rely on them for? What team members rely on you to get their work done? What do they rely on you for?

Co-ordination (assigning responsibility, synchronisation, integrating, minimise time wasting/replication)
4. How does your team co-ordinate to achieve that goal? How do you know who is doing what and when? How do you ensure all tasks are completed? How do you make sure that tasks get achieved on time?
5. Does your team use any technologies (e.g. programs/software/folders/documents) to co-ordinate? Can you explain what these are and what you use them for?
6. Does your team use any physical objects (charts/calendars/paperwork) to co-ordinate?
7. How does the office space influence team co-ordination? How does the current office space hinder co-ordination? How does it help team co-ordination?
8. How could the office space be changed to improve co-ordination? Have you worked in a different office where team co-ordination was better?
9. Does the office influence how you use face-to-face communication to co-ordinate?
10. Does the office space influence the kinds of technologies and objects you use to co-ordinate?

Individual work
11. How does the office space influence the way you do your individual work? How does the current office space hinder your individual work? How does it help your individual work?
12. How could the office space be changed to make it easier for you to complete your individual work? Have you worked in a different office where it was easier for you to complete your individual work?

Knowledge sharing (providing team members with information that can help them complete their work, training other staff members)
13. How does the office space influence information sharing? How does the current office space hinder information sharing? How does it help information sharing?

14. How could the office space be changed to improve information sharing? Have you worked in a different office where information sharing was better?

**Specific issues arising from observations**

- How did you team develop the open-plan office protocol? (Business Improvement Team)
- Describe your experience with working across two sites? Positives? Negatives? (Engineering Improvement Team)
- Describe your experience with hot-desking? Positives? Negatives? (Every team except the Business Support Team)
- Describe your experience with working from home? Positives? Negatives? (Business Improvement Team, Business Compliance Team, Customer Compliance Team)
- Can you tell me about the social contract (open-plan office protocol)? (Business Improvement Team, Business Compliance Team, Customer Compliance Team)

**Demography**


How many years have you worked for this organisation? (>1)(1-2)(2-5)(5-10)(10-20)(20+)

How many years have you worked in this team? (>1)(1-2)(2-5)(5-10)(10-20)(20+)

How many years have you worked in the office (where you have an allocated desk)? (>1)(1-2)(2-5)(5-10)(10-20)(20+)

Which of these office layouts have you worked in?

- Individual room office (only you in a room with 4 walls and a door)
- Shared room office (you and 1-2 other people in a room with 4 walls and a door)
- Small open-plan office with assigned desk (4-9 people in the same workspace)
- Medium open-plan office with assigned desk (10-24 people in the same workspace)
- Large open-plan office with assigned desk (>24 people in the same workspace)
- Have you hot-desked in any of these offices?