SPACES FOR INNOVATION

Jennie Andersson Schaeffer

2014
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Akademisk avhandling

som för avläggande av filosofie doktorsexamen i innovation och design vid Akademin för innovation, design och teknik kommer att offentligen försvaras fredagen den 26 september 2014, 13.00 i Filen, Smedjegatan 37, Eskilstuna.

Fakultetsopponent: Professor Bo Westerlund, Konstfack, Stockholm
Abstract

Workspace design, as an enabling factor in innovation, is an emerging topic for innovation and design research. However, little research has been done on users’ experience on workspaces for innovation in a manufacturing industrial context. The aim of the dissertation is to develop knowledge and understanding of workspaces for innovation from a user perspective.

The dissertation is based on studies done in four manufacturing industries and in one design and innovation consultancy, with a focus on the employees’ experience of the physical space in relation to innovation. The research method used was the photo elicitation interview. The 31 participants made photographs that served as a basis for verbal interviews to communicate the relationship they experienced between their workspace and innovation. The analysis and the interpretation of the material, supported by information, cultural and phenomenological theoretical perspectives, intend to contribute to the current scientific discourse in innovation and design.

A pattern was found in the results. In the manufacturing industrial companies, the majority of workspaces that users described as supporting or hindering innovation were motifs showing a culture promoting innovation in small steps. Their examples were found to be in close similarity to what previous research describe as characteristics of explorative innovation. In the design company, the most photographed motifs were workspaces and objects that supported different variations of what previous research defines as characteristics for a culture supporting radical, explorative innovation.

The dissertation presents results contributing to the research on ambidexterity, with focus on a possible coexistence between different innovation cultures. The results indicate that spatial differentiation creates possibilities for coexistence between the two innovation cultures. Six spatial characteristics were found in the descriptions of the workspaces related to the marginalised explorative culture in the manufacturing companies.

The dissertation discusses the possibilities of creating spaces for explorative innovation (SEIs) and space as a tool for innovation. An initial version of a support for design is presented.
Abstract

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In the dissertation the possibilities of creating spaces for explorative innovation (SEIs) and space as a tool for innovation are discussed. An initial version of a support for design is presented.
Abstrakt


I resultaten fanns ett mönster: i produktionsindustrin var platser för ett ständigt förbättringsarbete också de platser som uppfattades stödja innovation. Undantagen var få. På designföretaget exemplifierade de flesta fotograferade och beskrivna miljöerna olika varianter på en radikal, utforskande innovationskultur. Resultatet visade att de platser som kunde tolkas tillhöra en kultur för radikal, utforskande innovation var artefakter i en marginaliserad kultur i de studerade industri företagen. Resultatet indikerade att en samexistens mellan olika innovationskulturer i en kultur som domineras av exploaterande innovation (industriföretagen) möjliggjordes på individuell nivå av rumslig differentiering. Analysen av materialet pekar på sex karaktäristika i beskrivningen av användningen och upplevelsen av platser som kan samexistera och stödja en kultur för radikal innovation i kulturer som domineras av inkrementell innovation: Täckmantelplatser, Gråzon, Satellitplatser, Kameleonplatser, Tillfälliga platser och Anslutningsplatser. Dessutom visade resultatet att användare beskriver påverkan av flera modaliteter i sin upplevelse och förståelse av en arbetsplats som stödjer eller hindrar innovation.
Resultatet analyserades och tolkades med hjälp av tidigare forskning och begrepp från fenomenologi, informationsteori och kulturteori vilket bidrar till diskussionen om vad rum för innovation kan vara i den dynamik som uppstår i mötet mellan användaren, den vardagliga arbetsplatsen och innovation. Som ett resultat av analysen presenteras i avhandlingen ett förslag till designstöd formulerat som inlägg i en diskussion om och en process för hur arbetsplatsen kan stödja olika innovationskulturers samexistens.
I would like to thank all the companies and their personnel that took part in the empirical studies for the dissertation. I would also like to thank my supervisors, Professor Yvonne Eriksson and Professor Monica Bellgran, for supporting the work and providing constructive criticism at different stages.

I am grateful to all my colleagues and fellow PhD students in Innovation and Design at the School of Innovation, Design and Engineering, at Mälardalen University in Eskilstuna/Västerås and the Swedish National Design School, the Design faculty, based at the Royal Institute of Technology in Stockholm. Special thanks to the colleagues involved in the research projects "Design and Visualisation for Innovation in Production" (DeViP) and "Kaikaku–radical improvements in production" at Mälardalen University: Professor Tomas Backström, Professor Yvonne Eriksson, Professor Gabriella Goldschmidt, Professor Mats Jackson, Professor Roberto Verganti, PhD Jens von Axelson, Jan Brandt, Nina Bozic-Yams, Jose Colucci, PhD Sten Ekman, Daniel Gåsvaer, PhD Bengt Köping Olsson, Ragnar Tengstrand, Magnus Widfeldt, PhD Anders Wikström, PhD Yuji Yamamoto and Åsa Öberg. I would also like to thank the students in information design contributing to the pre-study, foremost Maria Axelsson, Lina Jakobsson and Moa Norrlander. I am especially thankful to PhD Cecilia Andersson who gave valuable feedback on my dissertation proposal, PhD Åsa Arketeg who made useful comments on the draft version of the manuscript at the final seminar, and PhD Anna-Lena Carlsson, who has been a truly inspirational researcher, reader and co-writer, throughout the process.

Some events have been particularly important for my research education. Thanks to PhD Isabelle Lettelier for the thought-provoking PhD course on "What is Seeing?" at KTH, Professor Lucienne Blessing for the discussion about photoelicitation, Professor Aarto Happala, PhD Epp Annus and others for creating such warm and congenial place for the exchange of ideas in the Nordic research circle. I am also grateful to the much needed writing impulses in the last months of writing from Ingrid Scherübl, Katja Günther and Judith Hench and for the sharp eye of Sofia Andersson, Peter Johansson and Associate Professor Judith Moldenhauer.
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The valuable discussions, cooperation with and interest from Afshin Ameri, PhD Baran Cürüclü, Lasse Frank, docent Inger Orre, Marianne Palmgren, Håkan Wannerberg and Christina Wirén among others have in different ways helped me to develop ideas and stay on the right track. Thanks to Krysia Lear for editing the English in the dissertation. I also wish to thank David Schaeffer and the rest of my family and dear friends, who gave me much treasured and kind support.

This project would have been impossible without the support of the KK Foundation (The Knowledge Foundation), and Vinnova research grants.

The errors and inconsistencies in the dissertation remain my own.
List of Papers

This dissertation is based on the following papers, which are referred to in the text by their Roman numerals.


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Dissertation structure

This section summarises the chapters’ contents in this dissertation.

I. Introduction outlines the background and the motivation for research on the relationship between workspace, user and innovation. The chapter includes the aim, objectives, research questions, delimitations and scope of the dissertation.

II. Background and Previous Research presents research on innovation and ambidexterity. This chapter also provides an overview of previous research on spaces for innovation.

III. Theories presents the theoretical base for the thesis. Here the notion of design, Bates (2006) information theory, Schein’s (1984) theory of artefacts in a culture and the relevant phenomenological notions regarding humans in relation to workspace are presented. Central terms in the dissertation are defined.

IV. Methods describes the approaches used to gather data and to analyse and describe the results. It also contains a method discussion. The chapter includes also parts of the empirical material in the description of the pre-study and of the companies.

V. Result and Analysis expands the content of the appended papers and describes, with help of examples from the material, the main findings. The results are analysed and interpreted with help of theory and previous research within this chapter.

VI. Discussion elaborates on how the dissertation presents new knowledge, and the issues of everyday, workspace design and innovation related to the results are discussed.

VII. Conclusions and Future Research summarises the results of the dissertation and their area of relevance. The chapter presents the avenues for future research opened up by the dissertation results.

APPENDIX: The dissertation has five appended papers, all of which were produced in collaboration with co-authors. The papers are appended in full, with an elaboration of the content provided in Chapter V. Jennie Andersson Schaeffer is the main author of the papers and had the main responsibility for data collection, writing and analysis. Appendix 6 is a copy of the instruction sheet used during interviews.
I. Introduction

To create physical and digital meeting spaces is one part of the Swedish National Innovation Strategy, since those spaces support exchange of information between individuals, companies and organisations and are seen as a key in innovation processes (Ministry of Enterprise, Energy and Communication [Swedish Näringsdepartementet], 2012).

Innovation capability, and how to support it, is considered to be of strategic importance for companies (ibid.).

On European level, Innovation Union is one of seven flagship initiatives to promote growth and jobs through innovation (European Commission, 2013a). In Innovation Union, the subject of workplace innovation has been prioritised (European Commission, 2013b). One important aspect of the subject is designing work environments so they support innovation.

In the description of workplace innovation, it is argued that “the way we organise our workplaces will play a vital role in the future of the European economy and its ability to compete” (Totterdill, Dhondt & Devos, n.d., p. 1). The growth of innovation capability is thus supported by national as well as European policies and research funding, and the research on spaces that support innovation is developing.

Moultrie, Nilsson, Dissel, Haner, Janssen and van der Lugt (2007) suggested that a physical innovation environment should be a conscious aspect of any innovation strategy. Moreover, in an overview of space, organisation and management thinking, Chanlat (2006) stated that space is a key issue for human organisation, but despite the importance it has not been central in management thinking until recently.

In previous research, studies focusing on the user's experience of the workspace in relation to innovation within existing manufacturing facilities were not found. This dissertation aims to contribute to the research on space and innovation with a focus on workspaces from a user perspective and to the discussion on how to organise the workspaces to support innovation in the manufacturing industry.

The whole citation was formulated as follows: “Workplace innovation is a generic term to cover – not ably but not only – innovations in the way enterprises are structured, the way they manage their human resources, the way internal decision-making and innovation processes are devised, the way relationships with clients or suppliers are organised or the way the work environment and the internal support systems are designed.” (European Commission, 2013b, p.1)
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On European level, Innovation Union is one of seven flagship initiatives to promote growth and jobs through innovation (European Commission, 2013a). In Innovation Union, the subject of workplace innovation has been prioritised (European Commission, 2013b). One important aspect of the subject is designing work environments so they support innovation.1 In the description of workplace innovation, it is argued that “[t]he way we organise our workplaces will play a vital role in the future of the European economy and its ability to compete” (Totterdill, Dhondt & Devons n.d, p. 1). The growth of innovation capability is thus supported by national as well as European policies and research funding, and the research on spaces that support innovation is developing.

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Design and dynamics in an ambidextrous organisation

Designing workspaces that support innovation in the manufacturing industry involves dealing with various challenges. One is the difficulty of supporting the coexistence of diverse improvement and innovation efforts, such as incremental (small steps to improve processes, products, services) and radical innovation. It has been argued that a great difference exists in the manufacturing industry between organisations and people involved in continuous improvement and those involved in radical innovation (Imai, 1986). Being an ambidextrous organisation, one that balances incremental innovation (also called exploitative innovation) and radical innovation (also called explorative innovation), makes an important contribution to the competitive advantage of the company. Although it has long been argued that providing an environment in which continuous and radical improvement can exist creates the most successful companies and is one of the biggest challenges management faces (Harrington, 1995), there is limited understanding of how to manage an ambidextrous organisation.

A gap exists in research on both individual and organisational levels of the underlying mechanisms, architecture and dynamics by which companies can have an environment of exploration and exploitation (Turner & Lee-Kelly, 2013 and Turner, Swart & Maylor, 2013). One task for research is to clarify the dynamics involved in creating environments that support both types of innovation (Turner, Swart & Maylor, 2013). If in today’s competitive market, the manufacturing industry is to become more innovative, it needs be aware of how to manage both incremental and radical innovations, as discussed by Harrington (1995), McLaughlin, Bessant and Smart (2008), Raisch, Birkinshaw, Probst and Tushman (2009), Turner and Lee-Kelly (2013) and Turner, Swart and Maylor (2013).

Design research provides the possibility to gain an understanding on the relationships created between users and their environment. Design is related to innovation both as a process and a product. Design as a process, can change and contribute to new ways of interacting and the outcome of the process can produce innovative services and products (see different perspectives in Utterback, 2006; von Stamm, 2008; Verganti, 2009; Halse, Brandt, Clark, & Binder, 2010; Koskinen, 2011 and Oksanen & Ståhle, 2013). Design as a product, for example, a physical space, can affect processes and dynamics in interactions (Dixon 1999; Leonard-Barton & Swap, 1999 and Fayard & Weeks, 2011).

To develop the understanding of underlying dynamics of both types of innovation, related to employees experience and reasoning around their workspaces, this dissertation implies a human-centred design research perspective.
Aim and Objectives

The overall aim of this dissertation is to develop knowledge and understanding of workspaces for innovation as a phenomenon from a user perspective. The first objective was to describe and analyse which workspaces users experience and describe as important for innovation and how the relation between workspace and innovation is experienced and described. The second objective was to understand whether and how workspace is involved in the way an individual or a group handle the coexistence of different innovation cultures.

Research questions

The aim and objectives, reformulated as a main research question and three sub-questions are presented below.

What could be experienced and described as spaces for innovation?

- Which are the spaces the user experiences and describes as supporting or hindering innovation?
- How do the users reason about their relations to the spaces experienced and described to support or hinder innovation?
- How do relations between users, workspaces and different innovation cultures take form?

The first two sub-questions were applied in a study of four companies from manufacturing industry and one design and innovation consultancy to learn which places users experience and describe as supporting or hindering innovation in those contexts. They were also applied to learn what underlying factors and dynamics related to those spaces based in the user perspective. The third sub-question was foremost applied in the four manufacturing companies. The intention was to analyse the users’ relation to workspaces and innovation cultures, based on how they reasoned about their relation to their workspaces. It was also an intention to study whether the user experience and descriptions of the workspaces could reveal possible strategies for promoting coexistence between exploitative and explorative innovation culture or not.

The analysis and interpretation of the material is intended to contribute to the current scientific discourse in innovation and design, concerning the research on workspace design for innovation and, if possible, formulate an initial support to designers, managers and others interested in how spatial design can support innovation.
Area of research and delimitations

The scope of the dissertation includes the role of workspace in innovation from a human-centred information-design perspective. It is limited to how the users experience their workspaces in relation to their understanding of innovation in their daily work, and the dissertation is placed in the research area of workspace design and innovation. The dissertation does not primarily study innovation labs or buildings intended to house innovation activities. The workspaces studied included production areas, offices and other facilities.

Workspace design research draws on several fields of research. One perspective in research on workspace design relates to ergonomics, which is concerned with methods, theories and data to maximise human wellbeing in workspaces and total system performance (Salvendy, 2012). In the field of production systems research, efficiency, productivity and production flow are studied in relation to the design and layout of the production area (Bellgran & Säfsten, 2010). Those perspectives are not developed in this dissertation. Contributions from research in management theory, information theory, design theory, psychology, architecture, cognition, neuroscience, philosophy, history and engineering, among others, are all relevant for workspace design but the in the dissertation the scope is narrowed down. Since the research perspective in this dissertation is workspace design in relation to innovation, research in workspace design related to innovation and research in innovation management is taken in consideration. The theories relevant for the scope of this dissertation comes form design and information theory, culture theory and phenomenology.

The research in situated cognition (Clark, 1998) and research combining neuroscience and architecture (Ebenhald, 2009) are also relevant for research on workspace design and innovation. While the link between cognitive science and architecture is not developed in this dissertation, this area of previous research has shown the importance of not excluding any way of expressing aspects of the complex embodied experience of the workspace. In our daily engagement with different spaces and our experience of them, there is a well-tuned interaction between our brains, bodies, social factors and external artefacts at play (Clark, 1998 and Ware, 2008). The research questions in the dissertation were formulated so as to not exclude the possibility that an interaction between user’s brains, bodies, social factors and artefacts had influenced the users’ experience and understanding of what was important and meaningful in a workspace described as supporting or hindering innovation.

Although several phenomenological concepts from Martin Heidegger are used in the dissertation, relevant notions to discuss spaces for innovation as ‘Riß’ and ‘artwork’ from Heidegger (1935-36/2005), was left out of the scope of the dissertation.
Culture studies are a field of research that has become relevant to the results in the late stages of the work with the dissertation. For example, Pierre Bourdieu’s (1984) theories, could contribute to develop understanding for the political and subversive power in the results. The reasoning about hierarchies and the opposition between ‘agents dominantes’ and ‘agents dominés’ [English ‘the dominated’ and ‘the dominators’, authors translation] are one example that could contribute of an interesting analyse of the material. Another relevant perspective to discuss the results is Michael de Certeau’s (1980) theories about the nature of tactics within spaces. An intensified study of the consequences of applying those theoretical directions to the results was left out of scope for this dissertation.

The Background and Previous Research chapter below introduces the broader context in which the research on spaces for innovation can be placed, and provides a review of what is currently known from previous research on workspace design and innovation. Relevant areas of innovation management research are addressed.
II. Background and Previous Research

In recent years practitioners have had a growing interest in the relation between the design of physical space and innovation. Practicing architects, design consultancies and managers have made numerous arguments about the most innovative companies understanding the link between innovation and the physical space, when creating, discussing and advertising different innovative spaces. This increasing interest from professionals in the field of design and innovation can be related to both an intensified focus on innovation and interior design.

Results from design research are useful in practice when making well-grounded decisions on how to design future innovative workspaces and to understand the dynamics involved in the relationship between employees and their workspaces in regard to innovation. Yet, as late as 2007, space and its relation to innovation was argued to be a rather unexplored topic. In fact, it was claimed that the relation between spatial design and its impact on innovation outcomes had not been established (Moultrie et al, 2007). Despite the consensus to consider environments on micro-level as important to support innovation, there were little empirical results reporting their benefits or the wider implications of the design of the workspace in relation to innovation (Toker & Gray, 2008).

Some of the previous research, presented below, can be criticised as being based on anecdotal success stories of managers or designers, a circumstance that Moultrie et al (2007, p.62) also pointed out. This shows one difficulty in the research on the relation between workspace design and innovation, it

Several examples of writings and examples of spaces for innovation have been done by organisations, innovation management consultancies, practicing designers and architects. One example is Steelcase, a design consultancy that designs office environments and manufactures furniture and stands behind the article "How place fosters innovation" based on stories of different companies in Steelcase's 360° Magazine (2010). Another is Armstrong (2013) writing in Forbes about "Innovation And Workplace Design: Beware These 4 Magic Bullets". Bushey (2013) relates branded spaces to innovation and Wood and Hoeffler (2013) examined how high tech artefacts were related to the perception of someone "looking innovative".

A practical handbook on ways to design space to improve team dynamics and ideas creation by altering the physical environment is Make Space written by Doorley and Witthoft (2012). Brown (1997) was early to argue that cultures that constantly produce innovation have a workspace design that supports the work of innovation.
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often has to be retrospective studies based on storytelling around the workspaces. It takes time for research communities to be involved since the outcome of innovation is judged by the success to create value regarding novelty in processes or products and the positive market reactions to them. The aspect of experience and the dynamics in interaction between users and spaces on micro-level risk to not be incorporated in the research based in retrospective storytelling. Innovation starts long before the market reacts to the outcome of innovation, is intrinsically linked with the environment, and is heavily dependent on interaction with the environment and the way people interact with each other (Peschl & Fundneider, 2012). From a design research perspective, it has to be acknowledged that the body-and-brain experience of the material artefacts is influenced by the here and now situation, combined with social factors and previous experience, which influence the relation to the workspace (Clark, 1998; Bates, 2006; Ware, 2008 and Ebenhart, 2009).

Innovation

‘Innovation’ is a concept filled with tension and one that has various applications. Innovation is considered a key factor for growth (European Commission, 2013a), which implies an expectancy of deliverance within the use of the term. Innovation is argued to not just coming up with something new (that is invention); it also involves the introduction of the new (Nordfors, 2009). This perspective is influenced by Schumpeter’s (1934/1983) definition of innovation in economy: bringing new products to the market, introducing new methods for production, opening new markets, controlling new sources of raw materials, and creating a new organisation.

As Oksanen and Stålhe (2013) have found, the notion of ‘innovation’ today is more open, inclusive and diverse than before. In the Swedish National innovation strategy (Ministry of Enterprise, Energy and Communication, 2012), innovation is about finding new or improved ways to create value for the society, companies or individuals. Innovation can be made in both small and big steps. Here, the definition of innovation is broad, with a focus on learning, and it is argued that innovation processes develop in relation and in exchange of information between individuals, companies and organisation. As a consequence of that reasoning, the Swedish National innovation strategy describes physical and digital meeting places as a postulate in the strategy, since those places support learning in and between individuals and organisations (ibid.). From that perspective, spaces for innovation become important in order to support innovation capability and create conditions for innovation. The perspective is supported by previous research on innovation. Innovation incorporates processes that enable informal communication and collaboration as a part of knowledge creation and learning in organisations (Nonaka & Konno, 1998; Dixon, 1999; Nonaka, Toyama & Konno, 2000;

‘Innovation’ is in this dissertation defined as human centred communication and environment dependent processes that mediate between two streams of activity that start long before the market reacts to the outcome of innovation. ‘Innovation’ is an overarching notion with two different modes of change: exploitative and exploratory. The two different modes affect artefacts, actions, experience and meaning creation differently. Exploration and exploitation have implications for cultures, structures, capabilities, processes, and strategies because they demand significantly different things of an organisation (Imai, 1986 and He & Wong, 2004). The manifestation of innovation is understood as newness and value-creation in processes, business models, products or services introduced to society. The manifestation of innovation is not the focus of this dissertation since the relation between different modes of innovation and value created in processes, business models, products or services introduced to society has, to a certain extent, been clarified within the research in the field of innovation and change management presented in the next two sections.

**Exploitative innovation**

Exploitative innovation has a character of incremental refinement of existing products with minimal risk taking. Exploitative innovation and its implications on a culture have characteristics of mechanical structures, refinement, efficacy, selection, implementation, execution, tightly coupled structures, path dependence, routine, control, bureaucracy and rules. Exploitative innovation leads to innovations that can have a lower grade of novelty than the outcomes from explorative innovation but are nevertheless an efficient, stable and low risk manner to achieve a certain level of newness and value creation in processes, business models, products and services (March, 1996; He & Wong, 2004; Jansen, van der Bosch & Volberda, 2006 and Turner Swart & Maylor, 2013).

In a manufacturing industrial context, when a factory is organised by the principles of lean production, the factory and the way of work share the characteristics of exploitation innovation. Lean production has its roots in mass production, and the focus on eliminating waste in production dates back to the scientific management, starting with Henry Ford in the 1920s (Womack, Jones, & Roos, 1991 and Liker, 2004). The process should be refined by taking small steps, in a work method called *kaizen*. Waste of any type, for example, of time or material should be controlled and reduced. The key characteristics of *kaizen* are often described as making continuous, incremental improvement and being participative and process-oriented (Imai,
1986). Lean production has been extensively described, developed and criticised and a number of supporting methods and tools have been developed and are broadly applied (Womack, Jones & Roos, 1991; Feld, 2001; Womack & Jones, 2003; Hines, Holweg & Rich, 2004 and Aoun & Hasnan, 2013). 5S is one tool, which were implemented in all 4 manufacturing companies studied, that introduces rules in the production units, gives structure and establishes routines over the placement of material, objects, and people in order to reduce waste as in the description of a lean factory by Greif (1991). 5S uses five Japanese terms (‘seiri’, ‘seiton’, ‘seiso’, ‘seiketsu’ and ‘shitsuke’), which can be translated into English as ‘sort’, ‘set in order’, ‘shine’ (systematic cleaning), ‘standardise’ and ‘sustain’ (Hirano, 1996). 5S strongly affects the design of visual information in production units and the placement of both tools and people. When the routines and methods are already known and implemented in the production unit, it is important to follow the structures. Greif (1991) and Bicheno (2004) suggested that visual management should be implemented in standard work and 5S. Visual management is used in a lean production context as a way to share information and control production. The control is related to what can be instantly seen in the factory environment. For example, Bicheno (2004) stated that high-functioning visual management provides immediately apparent, real-time information and feedback on the status of the plant. Standardisation aims to organise the workspace in a similar manner throughout the company, with marks where tools, furniture and equipment should be placed. Boards, instructions and displays should follow a standard. The aim of visual management is to allow all employees to understand how they affect the factory's overall performance (Greif, 1991; Peterson & Smith, 1998; Bicheno, 2004 and Scotchmer, 2008).

In manufacturing companies, the use of visual management has created an awareness of and an interest in the role of the visual and the design of the space in relation to innovation activities.

**Explorative innovation**

Exploratory innovation has a character of radical change and great risk. The characteristics of explorative innovation and its implication on a culture include detailed searches, heterogeneity, variation, risk taking, experimentation, play, improvisation, flexibility, discovery, organic structure, loosely coupled systems, external input, breaking of patterns, autonomy, uncertainty, openness, novelty and complexity. Exploratory innovation can bring outcomes with a character of radical novelty and high value in processes, business models, products or services (March, 1996; He & Wong, 2004; Peschl & Fundneider, 2012 and Turner Swart & Maylor, 2013). The exploratory innovation is here defined in close to emergent innovation as in Peschl and Fundneider (2012). Managing explorative innovation is a challenge because the process includes uncertainty, novelty and complexity, according to
Peschl and Fundneider (2012). Innovating and creating new knowledge in the explorative innovation mode cannot be managed in a mechanical manner. It is argued that an environment in which everyone has the opportunity of creating innovations and change, without hierarchies and decisions from above is more creative and brings out outcomes of higher level of novelty (Vedin, 2000). Peschl and Fundneider (2008) advocated an exploration of what wants to emerge. The explorative innovation is supported by innovation from within (ibid.). The emergent innovation, as they called it, depends on a large number of people in an organisation understanding and being able to reframe their deep assumptions. Additionally, the existential reflection and learning are important, a learning that does not primarily relate to the past but from what is emerging from the future (ibid.). The certain qualities demanded for emergent explorative innovation is characterised by Peschl and Fundneider (2012) as the ‘ecosystem of openness’ that will be further explained below in section “Space and innovation”. Additionally, Ekvall (1997) formulated 10 indicators for a climate for creativity, whose content overlaps with the ‘ecosystem of openness’ important for explorative innovation by Peschl and Fundneider (2012).

One approach to improvement in manufacturing industrial context, which relates to explorative innovation, is called ‘kaikaku’ in Japanese. Yamamoto (2013), noted that a kaikaku is rarely made. He showed that it involves some fundamental changes within production, cause dramatic performance gain, and are often initiated by top or senior management. A kaikaku performed in an industrial context shares more characteristics of an exploitative innovation culture then an explorative innovation culture (Yamamoto, 2013). Yamamoto (2013) suggested that, a kaikaku process could benefit from an explorative innovation culture.

**Ambidexterity**

An organisation requires both exploitative and explorative innovation streams of activity in order to be successful (Harrington, 1995 and Raisch et al, 2009). According to Raisch et al (2009), the companies that find ways to do it, the ambidextrous companies, are the most successful. One factor for prosperity is that a coexistence of both incremental and radical innovation will “encourage the growth of an ‘ambidextrous innovation’ capability” (McLaughlin, Bessant & Smart 2008 p. 319).

Raisch et al (2009) have discussed tensions that affect how ambidexterity is developed. The first tension is differentiation and integration. A company has a strategy of either separating exploitative and explorative activities or integrating them (ibid.). The second tension is whether the integration or separation of ambidexterity takes place on an individual or organisational level. On the individual level, ambidexterity is rooted in individuals’ ability to explore and to exploit (ibid.). At the same time, the individual dimension of ambidexterity is difficult to handle for the individual because it demands
that a person inhabit or can mediate between two ‘thought worlds’. Innovations require insights from a variety of specialities, in other words, from different thought worlds or thought collectives (Fleck, 1979 and Dougherty, 1992). However, on an organisational level, a company that has departments with different thought worlds and different basis of knowledge faces obstacles to easily sharing ideas. A central idea or action presented by one person can be viewed as meaningless by someone in another department or thought world (Dougherty, 1992). The organisational routines separate the thought worlds rather than synchronise them (ibid.). For example, findings presented by Adler, Goldoftas and Levine (1999) show that continuous improvement work is combined in a parallel organisational structure with quality circles and pilot teams, which is called “tactical” differentiation by Raisch et al (2009). Ambidextrous companies separate exploration and exploitation by location on the organisational level. R&D departments are often then separated from other parts of the company (Volberda, 1998 and Tushman et al, 2010).

The last tension is the internal and external perspective; social networks are important where strong ties are needed to integrate knowledge, for example, within a company. In addition, employees need bridging ties to external contacts to access diverse and new knowledge (Chesbrough, 2003 and Raisch et al, 2009.).

As shown in previous section, from an innovation research perspective, the different types of innovation make the research task complex. The demand for research on the underlying dynamics and mechanisms involved in the coexistence between different innovation cultures has not been sufficiently met (Turner, Swart & Maylor, 2013 and Turner & Lee-Kelly, 2013).

A phenomenological perspective can make a contribution to understand more of that dynamic from the perspective how individuals describe their experience of spaces in relation to innovation. Applying a phenomenological perspective to a study of human relation to the built environment is not new. Seamon (2000) has done thorough research in the field of phenomenology and its relevance when studying the built environment. Additionally, he has suggested that phenomenology can be used in the interpretation of architecture and that it contributes to improved design (1982). An overview of the use of philosophy, including interpretations of Martin Heidegger’s writings in research on architecture, has been described by Wallenstein (2004). Phenomenological studies have related certain uses and meanings of spaces to a user, for example, in investigating peoples’ meanings of home (Sixsmith, 1986) and space in relation to installation art (Rebentisch, 2012). Phenomenological studies have not been found applied to an investigation of peoples experience and meanings in relation to workspace and innovation.
The previous research found on the relation between innovation and physical space can roughly be categorised into four fields (figure 1). Space for innovation has been researched on macro level, treating space for innovation in large scale; and on micro level, focusing on the building and interior. The research presented below, incorporates to various degrees both physical spaces (covering both whole regions and interiors) and immaterial spaces (including both the individual mental space and innovation culture in an organisation) in their definition of spaces for innovation.

Research on the macro level investigates innovative milieus, industrial districts and innovative companies in agglomerations (see A in figure 1). In that research, the smallest unit of physical space refers to relations between different buildings, and space for innovation is also considered as a geographic area (see Sternberg, 1999; Simmie, 2005; Fritsch & Slavtchev, 2007; Törnquist, 2009 and Capello & Lenzi, 2013). For studies of spaces for innovation on a micro level, as this dissertation, the relations in districts and networks are relevant when specific workspaces are the interface for meeting the outer world. What is developed and experienced inside a workspace on a micro level and a macro level can be interdependent (Raisch et al, 2009).

One way that previous research on the micro level regards space for innovation is as a specially designed dedicated space (C in figure 1). The PEI study made for the dissertation focused on everyday workspaces and not specially designed dedicated spaces, still the perspective of an ‘innovation laboratory’ is of relevance, as a part of the argument to perform the current study and to discuss the results in the dissertation.

The specially designed space is characterised by a displacement of users from their day-to-day activities to an innovation laboratory (Lewis &
Moultire, 2005) to or a building dedicated to innovation (von Krogh, Ichijo & Nonaka, 2000). According to Lewis and Moultire (2005), when the user is being dislocated from day-to-day activity, the physical design of the space is central to its functionality in reducing hierarchy and supporting participation. They also suggest that direct facilitation remains critical to fruitful function. Lewis and Moultire (2005) found that an innovation laboratory could reinforce corporate commitment to innovation and creativity by its physical manifestation. According to Lewis and Moultire (2005), the design of an innovation laboratory can support creative climate since it supports dynamism, playfulness and debate, three of the characteristics for a creative climate defined by Ekvall (1997). When creating an innovation laboratory, the challenges are the substantial financial investments required and the possibility that such spaces can have short useful lifespan (Lewis & Moultire, 2005). Their work was based on three studies of laboratory facilities in a government department, an academic institution and a service company.

The spatial design interventions, to which an innovation laboratory contributes, affect the dynamics in a workspace. The use of dislocation of people to a special space for radical innovation can be found in manufacturing industry, foremost, in the way Toyota has used the obeya room. Translated into English, the term ‘obeya’ means both ‘big room’ and ‘the nerve centre for team activity’ (Ratâ & Stefanovic, 2011). An obeya can be viewed as an innovation lab in the lean production context. With obeya, there is a combination of tearing down communication barriers, gathering a divergent group from different departments, and visualising the process. This organisational strategy is used by Toyota to support the development of new products. The obeya process has been shown to increase communications and coordination among teams and make an impact on the end results (Mullin, 2003; Aasland & Blankenburg, 2012 and Javadi, Shahbazi, & Jackson, 2013). A retrospective study of an obeya room by Anderson and Bellgran (2009) confirmed that, despite the perceived positive contribution to processes, this type of dedicated space has a short life span, as previously shown by Lewis and Moultire (2005) also in a manufacturing industrial context.

The materiality of a building, both as a way to dislocate people from everyday activities and as an unusual sensory experience, is presented as one important aspect of design of spaces for innovation. Previous research has described the way in which a building can stimulate different senses as characteristics of a space for innovation (von Krogh, Ichijo & Nonaka, 2000). An example of an innovation building (to stimulate a insurance company office workers innovation) was Skandia’s Villa Aspudden in Sweden. Their Future Centre provided a multi-sensory experience, including the odours and feel of materials. It was considered to successfully support innovation (ibid.)

A conceptual framework for evaluating spaces for innovation in different contexts was presented by Moultirie et al (2007). The goal was to evaluate spaces, foremost innovation labs against the strategic innovation intent for
the spaces (ibid.). The framework contributed with a support to evaluate created spaces with a strategic intent for innovation, and then evaluate how the intent was realised when the spaces were used.

Figure 2. The main parts in the framework by Moultrie et al (2007). (The figure layout altered by J. Schaeffer).

Peschl and Fundneider (2008, 2012) and Nonaka, Toyama and Konno (2000) (see B in figure 1) present a different way to regard space for innovation compared to Lewis and Moultrie (2005). The space for innovation is described with floating boundaries between the micro and macro levels and between the immaterial and physical space for innovation. This kind of space for innovation is described as an ‘ecology of openness’ by Peschl and Fundneider (2012) or the concept of ‘ba’ according to Nonaka and Konno (1998) and Nonaka, Toyama and Konno (2000). This research is of theoretical character, and its direction concern organisations in general.

With the research of Peschl and Fundneider (2012), two important concepts for the research on the relation between spaces and innovation were introduced, that of ‘enabling spaces’, spaces that enable the ‘ecology of openness’ to emerge. An enabling space is a space “supporting, enabling and facilitating processes of innovation and knowledge creation.” (ibid., p. 48). Peschl and Fundneider (2012) advocate developing attitudes, values and practices of openness to create the ecology of openness. The authors suggest that people create a context in which they can train their patience and their ability to wait for the right moment, to reflect, but also an context to radically question themselves, listen, observing closely and to listen to weak and fragile signals and to cultivate and incubate them. In conclusion, to manage explorative innovation people have to “[…] learn how to provide an ecosystem or ‘living ambiences’ of cultivation, facilitation, incubation and enabling, rather than a regime of control and forced change.” (ibid., p. 46). They point to an ecology of openness as something opposed to a controlled environment. They argue that both physical space and the organisational climate should be a part of the enabling context. They present one result related to actual design for the design of such spaces, showing a multi-functional university environment (ibid.).
Nonaka, Toyama and Konno (2000) found the basis of innovation to be in dynamic knowledge creation through interactions within one individual but also among individuals and between individuals and their environment. They presented the concept of ‘\textit{ba}’ as a shared space/place that served as a foundation of individual and collective knowledge (Nonaka & Konno, 1998 and Nonaka, Toyama & Konno, 2000). \textit{Ba} consists of physical space, virtual space and mental space; it does not have to be related to a certain time or place (Nonaka, Toyama & Konno, 2000). Its boundaries are fluid and can be changed quickly with help of the individuals that are present; it has a quality of here-and-now (ibid.). The writers quickly cover how to build the physical aspect of \textit{ba} and formulate it as providing “physical space such as meeting rooms” (ibid., p.25). The physical space can also be spontaneously created, which means, according to this reasoning, that a space for innovation can be created in the moment within a workspace. To create the right condition for \textit{ba}, autonomy, creative chaos, redundancy, variety, love, care, trust and commitment have to be provided (ibid.). How those conditions are supported or could be supported by the workspace design is not problematized in Nonaka, Toyama and Konno (2000). The research presents examples from diverse contexts as insurance companies, stores, universities and freezer manufacturers.

Previous research on the micro level and with focus on physical space (see C in figure 1), regards space for innovation as space in process and supporting communication and interaction. The relation between workspace design and innovation is dependent on the possibility to affect behaviour patterns with changes in the workspace design. Change in workspace design leads to change in behaviour patterns, behaviour patterns to increased informal communication, and then informal communication to innovation (Toker & Gray, 2008; Senoo et al, 2007 and Fayard & Weeks, 2011). Hallways are pointed out in previous research as informal meeting spaces stimulating informal communication and collective learning by exchange of data, conclusions and questions. The results were based on examples from a steel recycling company, a food producer and a health organisation (Dixon 1999). The design of the workspace is of importance for innovation, both when people plan for and want to work together for creative meetings, make decisions, need to work alone or occasionally meet for informal conversations (Allen & Henn, 2007 and Senoo et al, 2007).

Time proximity and space proximity support communication as well as innovation (Moulttrie et al, 2007). Proximity related to communication and collaboration is also discussed by Allen (1977), Haner (2005), Bouteiller et al (2008), Wineman, Kabo and Davis (2009), Hua et al (2010) and Fayard and Weeks (2011), as a factor that is important for workspaces supporting innovation. But to really provide an environment where informal communication comes about is not about following a formula to creating open floor plans, proximity of offices and meeting rooms, and common areas to en-
encourage informal conversations. The design can fail if various underlying factors and people's experiences are not taken into account, a perspective explored to a certain extent by Fayard and Weeks (2011).

Fayard and Weeks (2011) presented three factors for workspace design intended to support innovation: ‘privacy’, ‘proximity’ and ‘permission’. Stimulating proximity in the spatial layout means that the design leads people to common areas and gives them reason to remain there. The space must also have a degree of privacy where people can feel confident that they can talk without being interrupted or overheard. Alcoves, for example, provide privacy in open spaces. Management and culture, as well as the design of the space and the things, must encourage and give permission to informal dialogue. Furniture, experienced as comfortable can help to communicate this (ibid.). Considering the various aspects characterised by Nonaka, Toyama and Konno (2000) and Peschl and Fundneider (2008, 2012), in the concept of ‘ba’ or the ‘ecology of openness’, the underlying factors relating to spaces for innovation from a user perspective may be even broader than the factors presented by Fayard and Weeks (2011).

In a recent study, Oksanen and Ståhle (2013) present five attributes of innovative space, a space that support innovation as a communicative and human-centred process. They suggest the attributes: ‘collaboration enabling’, ‘modifiability’, ‘smartness’, ‘attractiveness’ and ‘value reflecting’. As in the results of Leonard-Barton and Swap (1999) and Fayard and Weeks (2011), those ‘collaboration enabling’ spaces are modifiable and have to follow the changing needs of a user, and allow for both collaboration and privacy. Developing ‘attractiveness’ must take into consideration location, architecture, service and intangibles such as creativity and aesthetics (Oksanen & Ståhle, 2013). The ‘smartness’ considers leaning spaces being integrated with new technologies. ‘Value reflecting’ means that it has to reflect both the values of the company and the identity of the users. Innovation space was presented as an innovative service that can be provided to diverse users (ibid.). In Oksanen and Stålhe (ibid.), the interviews were made in retrospective and the information in the narratives derived from experts. Their work combined a literature review with benchmarking and interviews in a university environment and what was called innovative locations used by pioneers from the US (ibid.).

The focus of previous research exploring the relation between physical space and innovation has been mainly on office environments, R&D departments, creative companies and university contexts. Not one study was found to focus on the perspective of where the users themselves identify workspaces for innovation on a micro level and how ambidexterity is practiced in relation to workspaces from a user perspective. The niche of the research in the dissertation is the focus on manufacturing industrial companies, the experience of the user and everyday workspace on micro-level (see D in figure 1) and the perspective of ambidexterity.
II. Theory

To place the research on spaces for innovation as experienced and described by a user into a theoretical context, this dissertation draws on design theory, information theory, cultural theory, and phenomenology. These theoretical perspectives and the notions associated with them have been central to the analysis and interpretation of the empirical material, but also influenced the choice of the method to gather empirical data. In different ways, these theories all describe how workspace is a part of a wider context and how workspaces can be experienced and understood in relation to innovation.

The chapter begins by discussing the concept of 'design' and navigating the landscape of design relevant for the dissertation. Thereafter, the chapter examines 'space', how it can be understood from theoretical viewpoints as constituting forms of information, how space relates to culture and how space relates to human and the everyday from a phenomenological perspective. This chapter provides an understanding of how and from what theoretical perspective the concepts 'space', 'place', 'workspace', 'artefact', 'culture', 'tool', 'thing', and 'human/user' are used in the dissertation.

Design, defined as both a process and a product (Leonard-Barton & Swap, 1999; Utterback, 2006; Verganti, 2009; Fayard & Weeks, 2011 and Oksanen & Ståhle, 2013), when the notion 'design' refers to the product of design, for example, a workspace, it is experienced and used by someone, who in the design context is called the 'human' or the 'user'. The product of design is not separated to the users, they contribute to the different stages of design processes and change designed spaces with their actions as discussed by Krippendorff (2006) and Koskinen et al. (2011). The notion of 'human-centred design' (HCD) builds strongly on thinking around design in the 1970s called participatory design. This was a shift in design towards informing the designer about the context (Koskinen et al., 2011 p. 18f) and has recently been applied in research on the design of future factories (Wikberg Nilsson, 2012) and in various participatory design projects presenting propositions for future designs (Halse et al., 2010), and future workspaces (Horgen, 1999). In HCD the users play a fundamental part in the design process.
III. Theories

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Design

Design, defined as both a process and a product, is related to innovation (Leonard-Barton & Swap, 1999; Utterback, 2006; Verganti, 2009; Fayard & Weeks, 2011 and Oksanen & Ståhle, 2013).

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accordance with Krippendorff’s (2006) definition of HCD, which elaborates on user’s role and the context in design, the everyday world is an important aspect of design. ‘Everyday’ is important both as a notion of where the need, criteria and challenges for design emanate, and where the product of design should negotiate its place (ibid.).

Figure 3. Distinctions within design practices, human-centred and technology-centred design. The definition of design used in the dissertation is human-centred information design (HCID), here placed in the field of design. Model from Krippendorff (2006, p. 32) modified by J. Schaeffer introducing the design loop and the notion of ‘HCID’.

Information design are concerned with the design processes and artefacts or services for communication activities. Information design is therefore an area of design that is highly context dependent. The theoretical base for information design builds partly on both design– and information theory. Related to human-centred design theory, human-centred information design (HCID) processes, are processes in which humans, the artefact and the use of the artefact are involved in an iterative and cross-pollinating process (see figure 3). HCID, has a niche within the field of HCD. Drawing on the definition of HCD (Krippendorff, 2006), the role of the user is given an accentuated importance in HCID, since information design is centred around communication and understanding supported by the context. The designer, in the field of HCID, has to find ways to understand the user’s understanding of the context and be in a process of co-creation in order to design workspaces that can be optimised for the activities intended to take place there. To understand the user’s understanding of the context is not to buy into what the user “wishes for”; it involves going beyond the superficial statements, learning more about the complexity of what is involved in the context and why, and from that knowledge being able to design appropriate supports for innovation.
Space

‘Space’ as a noun has been in use in English since the 13th century (Encyclopedia Britannica Online, 2013). Etymologically, it comes from the Latin word *spatium*, meaning area, room and interval of space or time. It is used to mean “an extent or area available for or used up by some activity or thing” (ibid.). ‘Space’ is also used as a metaphor to describe an opportunity for privacy or time for oneself and the distance from other people or things that a person needs to remain comfortable (ibid.). In English, the noun ‘place’ is sometimes used as a synonym for ‘space’. The use of the word ‘space’ in the dissertation takes its starting point in describing an area or a room used for activities and things – but expands to describe an area or room experienced and interwoven with relations.

Three perspectives will be used to define the expanded definition of space and its related notions. The first will study space as being constituted of forms of information; it will revisit the information theories of Marcia J. Bates (2006), as presented in paper I and developed in paper III. The second perspective relates space to culture as described by Edgar H. Schein (1984) and the third will relate space for innovation from a user’s perspective to concepts within Martin Heidegger’s phenomenology.

Space as constituted of forms of information

A workspace can be filled with relations between objects, furniture, signs, texts and humans. One way to define space as relational is to use Bates’s information theory (2006). The relational definition of space based on the information theory of Bates (ibid.) highlights that the user experience and interaction with a workspace depend on different parts that are related and the theory helps to both separate and re-combine them.

Bates’s theory of fundamental forms of information put forward that the values in a culture (i.e. enacted form of information) affect the workspaces. In the theory, enacted information affects how spaces, images and texts are formed. According to this theory, when enacted information takes form in spaces and objects, the form of information becomes embedded. Images, texts, and signs are understood as recorded form of information. What people express with words or body language is called expressed form of infor-

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3 Etymologically ‘place’ has another history than ‘space’ (Encyclopedia Britannica Online, 2013). The etymology of ‘place’ directs the word to an origin connecting the human body with the surrounding environment, in contrast to the etymology of ‘space’. As used in Sanskrit, *prthu* means broad; it is related to the Latin word *platea*, broad street, a flat surface and also where the human body meets the ground. In Latin, *planta* means sole of the foot (ibid.). It is relevant to call the spaces in the study places, especially taking a phenomenological perspective, instead of experienced spaces. After several alternations, the notion of ‘space’ was used instead of ‘place’.
mation. The enacted information also affects how people experience (i.e. experienced form of information) the embedded, the recorded and the expressed forms of information. (For a detailed definition of the fundamental forms of information see appended paper I.) Bates’s (2006) information theory suggests that relations exist between artefacts, humans and the surrounding environment. For instance, the embedded form of information consists of small and big objects; it can range from a building to a chair, which can be affected by human action, an action that in turn is related to values (the enacted information). To put it briefly, when using the theory fundamental forms of information, the workspace becomes a part of the flow of information.

As an analysis tool, Bates’s (2006) fundamental forms of information provide a language and a framework to relate categories of space to information. It gives a vocabulary for the different forms of information at play in a spatial context. In appended paper I, the information theory was used to untangle the forms of information interwoven in workspaces used for various communication purposes. In Schaeffer (2011), the fundamental forms of information were combined in a model in an attempt to describe a space for communication where the different parts’ relationships to each other constituted a space (figure 4). In Schaeffer (2011), the interrelations were called ‘communication space’, which meant a space where the different forms of information came together.

![Figure 4](image-url)

Figure 4. When recorded form of information meets embedded, experienced, expressed, and enacted forms of information, they constitute a communication space (Schaeffer, 2011).
Because of the experienced information was one form of information interlaced in the space, it gave a role to humans as a part of that space consisting of things, neural activities, images, values, words and movement. The theory implies that all fundamental forms of information are affected by our values.

Bates’ theory has an opening to contextualise the fundamental forms of information. In her discussion of the question of meaning, Bates (ibid.) divides the definition of information into categories that are on a higher level and is overarching the fundamental forms of information. Here, information is a pattern of organisation of matter and energy (named Information 1), and some of these patterns are given meaning by a living being (named Information 2) (ibid.).

The theory relates objects, texts, lights, words and actions that were experienced by individuals and interpreted by them to information. When information is received as Information 1 in the form of sounds, smells, colours, structures and so on it is here understood as interlaced with what Bates (2006) defines as Information 2, the patterns that are given meaning by the receiver's interpretation. It has to be pointed out that an information theory that allows for information as subjective and objective is fruitful but also debated (see Hjørland 2007, 2009) and is a contradiction to the phenomenological theoretical perspective in the dissertation. In the dissertation, the forms of information were used as a tool to analyse what were experienced, described and shown by the participants in the study. The model shown in figure 4 was used in appended paper III to present what forms of information found interlaced in a space for innovation in the empirical material. In the analyse, there was a need to combine Bates’s theory with an additional theoretical approach because Bates (ibid.) lacks a discussion of how human beings create meaning and the qualities experienced in the relation between human beings and environment.

Culture and space

The values humans have influences the forms of information, according to Bates (2006). To understand how recorded and embedded information are connected to humans’ values, one approach is to build on Schein’s (1984) theory of organisational culture. His writing on culture is useful for interpreting the results because it points to the role of the artefact as a part of a culture.

Culture

According to Schein (1984), cultures consists of groups of individuals that have basic assumptions (beliefs, habits of perceptions, thoughts, and feelings) and a correct way to perceive, think and feel in relation to problems of external adaptation and internal integration. Those assumptions that individ-
uals in a group consider to be the correct way to perceive, think and feel in relation to problems of external adaptation and internal integration, may be called the dominant cultures. But, as the research of Deborah Dougherty (1992) shows, how people think and act about innovation in one group can create barriers to work and collaborate with individuals from another group, from another ‘thought world’. The thought world is related to the thinking and action on group level, and was studied on the base of individuals’ descriptions of product innovation projects. Much in similarity with Schein’s (1984) definition of culture, Dougherty (1992) asserts that a ‘thought world’ is the pattern in a group’s thinking and action about innovation that provide shared assumptions about reality and how to identify and understand what is relevant issues in innovation.

Building on Dougherty (1992) and Schein (1984), individuals in groups may consider some assumptions and ways of perceiving, thinking and feeling about innovation and spaces related to innovation to be incorrect or to work less well in relation to problems of external adaptation and internal integration, and then belonging to another thought world related to another culture. The assumptions and ways of perceiving, thinking and feeling about innovation related to another thought world are in this dissertation defined as belonging to assumptions in a marginalised culture.

**Artefacts in a culture**

Schein (1984) points out that a culture can be analysed with help of the different levels of visibility of a culture. According to his theory, the most visible level of a culture is the artefact, which includes written language, physical space, and layouts of a company’s facilities. More elusive are values, which represent unspoken rules that the members of a culture are expected to instinctively know. Unspoken rules are often indirectly visible in the way in which a space is organised.

The least visible level of culture is underlying assumptions, which are beliefs, habits of perceptions, thoughts, and feelings. According to Schein (1984), organisational artefacts and values can reveal information about the underlying assumptions. Schein’s (ibid.) definition of organisational culture suggests a group forming a culture for exploration would produce and understand artefacts differently than a group forming a culture for exploitation.

Verbal interviews and content analysis of documents only identify the values manifest in a culture. People focus on their ideal reasons for behaviour, not on their underlying assumptions, which are “concealed or unconscious” (ibid., p. 3). Studying motifs of workspaces and the descriptions of them provides an opportunity to learn about how a group relates to artefacts and the group’s connections to innovation and an innovation culture or its lack of connection. It is also possible to learn what characteristics the artefacts have. As Schein (ibid.) points out, it is much harder to understand why members in a group do what they do. That is why the choice of method be-
comes important, since it has to be a method that has the potential to go beyond what Schein (1984) describes as the manifest values in a culture and reach for the underlying assumptions. That is also why the relation between humans and workspace from a phenomenological perspective is elaborated on in the next section.

Space and phenomenology

In this dissertation phenomenology contributes to the interpretation of the experience of a workspace and how a study of photographed motifs and their descriptions gives a possibility to understand the assumptions forming the user relation to workspace and innovation.

Some concepts from Heidegger in relation to HCID are used in this dissertation to elaborate on and understand the user experience of space for innovation. Certain concepts from Heidegger’s phenomenology in Being and Time (1927/2010), Building Dwelling Thinking (1958/2008) and The Origin of the Work of Art (1935-36/2005) are used. The concept of ‘user’ and ‘human’ from HCID will be developed with Heidegger’s ‘Dasein’. The everyday and the workspace as a part of the everyday in HCID will be developed in relation to ‘everydayness’ and ‘dwelling’, the relation between an artefact and the user, will be related to the notion of ‘tool’ and how human can relate to a tool will be developed with the concepts of ‘ready-to-hand’ and ‘present-at-hand’ and related notions. The concepts provide a way for discussing what space for innovation is, in use and in experience. Heidegger’s perspective on everyday artefacts is that they are first being understood from their use and within experience. This approach helps to

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4 To use certain passages from Martin Heidegger, without considering the author’s political standpoint has been widely discussed, for further elaboration on the topic see Timothy Clark (2002) who examined the possibility of reading the philosophy of Heidegger apart from his political standpoint; Clark discusses the era of Nazism and the question of whether Nazism contaminates Heidegger's philosophy.

In this dissertation the ethical dilemma is confronted so the passages in the texts of Heidegger are carefully interpreted, as an attempt to an open re-reading from a design perspective. The texts are used as a possibility to analyse, interpret and discuss the artefacts involved in work life and the human experience of workspaces in production. The move into an industrial and design context of his theories is done within this thesis, which leaves behind more aspects than Heidegger’s political standpoint. For example, Heidegger was critical of the way technological structures profoundly affects the ways things appear, see The question concerning technology and other essays (Heidegger, 1954/1993). The texts are not used in the dissertation as a critical reading of the technological structures, but to stretch and expand the discussion around how the technological structures may or may not work when researching, experiencing and designing spaces for innovation. It has to be acknowledged that the workspaces in focus for the descriptive study are included in the technological structures that Heidegger criticized. Those who want to discuss the problems with this move and the use of the concept from Heidegger (1927/2010; 1958/2008 and 1935-36/2005) from several perspectives, including the ethical perspectives, are invited to do so.
problematise spaces for innovation in the scientific discourse in innovation and design research and is also a benefit to the industrial and societal contribution, since it is focusing on experience and the emergent micro relation between users and artefacts in daily life.

**Space and user**

In opposition to Bates (2006) definition of Information 1 (where space is defined as the pattern of organisation of matter and energy), from a phenomenological perspective space does not stand for itself, it can only be described from a perspective within someone’s experience. Heidegger’s notion of ‘Dasein’ has relevance for HCID because it expands the reasoning about how humans are interlaced with their environment. Heidegger’s notion of ‘Dasein’ in Being and Time (1927/2010, p. 53ff) implies that there is no worldless being, the being is always being-in-the-world. ‘Dasein’ is here understood as the kind of entity that human being as such is (but not a person). An objective standpoint cannot explain the phenomenon of the world, the complex of meanings that creates being-in the world. When Dasein is being-in-the-world, Dasein is not “placed ‘in’ a space” but have ways of being-in-the-world (1927/2010 p. 56). Being-in is indicated by examples of “[…] to have to do with something, to produce, order and take care of something, to use something, to give something up and let it get lost, to undertake, to accomplish, to find out, to ask about, to observe, to speak about, to determine …” (ibid., p.57). These kinds of being-in interlace Dasein with space and involve ways to be-in-the-world based on the everyday experience of and understanding of the surrounding world. As one example of how distance is experienced Heidegger (1927/2010 p.107) described a street as a useful every day ‘tool’ for walking. The street is felt by every step through the feet, it is close to the body and seems to be the nearest. But in experience, if we see a friend on a distance, the street could be experienced as more remote than the friend.

**Space as a ‘tool’**

The notion of ‘tool’ can be further used to discuss how space for innovation could be experienced in use, and clarify how experience is related to understanding. To follow Heidegger’s reasoning (1935-36/2005), the notion of ‘tool’ is an object being useful and the qualities of the tool are experienced with the body in use. The tool has a material side, and in that sense it has similarities to a ‘thing’. The concept of the “tool” is in the dissertation used to include whole workspaces, not just objects.

According to Heidegger (1935-36/2005), who separates the tool and the thing in experience, a thing is positioned as complete in itself (p. 22). A thing in use can bring together form and content. Its being then becomes a ‘tool’ that serves a purpose (ibid.).
Because space interpreted as a tool also includes the experience of the space in use, the notions of ‘present-at-hand’ and ‘ready-to-hand’ can inform how space as a tool is handled and understood.

Present-at-hand and ready-to-hand
Heidegger (1927/2010) regards the experience of a tool in use as the basis for understanding it. The artefacts around people are given to them in different modalities of being, which can be described by the Heidegger’s concepts ‘present-at-hand’ or ‘objective presence’ (German Vorhandenheit) and ‘ready-to-hand’ or ‘handiness’ (German Zuhandenhalt) (see Heidegger, 1927/2010, p. 70–76 and Inwood, 1999, p. 3 for the two translations). 5

Building on his theory about human’s relation to tools and things, to learn about the way a tool is, the understanding is grounded in the experience when doing something with it and not in looking at its material properties (1927/2010, 72f). At work, humans use tools, for example, without reflecting about them and, according to Heidegger, do not see them objectively, but has a special way to be in relation with the tools. This special relation are included in handling the tools and are guiding the operations, the tools are being ready-to-hand (Heidegger 1927/2010 p.69f.). Simplified, tools are given initially as ready-to-hand in the use of them before they are given as present-at-hand. This means that when people are asked about their workspaces or parts of workspaces, they are being asked about something that usually disappears in use. In Heidegger’s (ibid., p. 68) perspective of ready-to-hand, a prototype workshop is the prototyping, (i.e. the prototyping activity taking place). The tool, when it is experienced as ready to hand, are involved in a meaningful context where a tool is used in order to do something to achieve something.

But the tool can become present-at-hand (ibid., p. 70-71), which it does when the ready-to-hand relation gets interrupted. In Heidegger’s thinking, an interruption can make a whole life world become visible (Polt, 1999). Heidegger describes an occasion like this as the moment when the tool provides resistance to being used, it becomes unready-to-hand (1927/2010, p 73f). The invisible relationship has to be disturbed to be visible. The ‘unreadiness-to-hand’ occurs when the tools cease to function or there is an obstacle to using them. Heidegger has three ways in which something can become unready-to-hand in experience: 1) when a tool is damaged or broken (conspicuous); 2) when a part is missing so a tool cannot function (obtrusive); and 3) when the entity prevents us from pursuing a project (obstinate) (ibid., p. 73f.). The obstacle creates a possibility experience the tool in a new

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5 Fruitful and interesting connections occur between HCD research and phenomenology in how we create our relations designed objects. Heidegger’s notion of ‘tool’ in relation to designed objects are in design research acknowledged, for example, to a certain extent by Krippendorff (2006).
way. The modes of conspicuousness, obtrusiveness and obstinacy make the character of the tool as present-at-hand come forward, but it is still related to the ready-to-hand relation to what it was when it was in use (ibid., p.74f). For example, when a tool is damaged, missing or there is a hinder to use it the reaction (for example to be upset) and the reflection over the situation from the user give a reference to what the tool was used for and what is was used with and bring attention to other references the user relates to that tool. The experience of a tool in use, can in its mode of becoming present-at-hand, be reflected over, discussed and understood in a new way.

To continue the elaboration of humans’ relations to workspace, the interaction with and the experience of space is influenced by different attitudes.

The everyday workspace and innovation
Workspaces are spaces the employees in the studied companies come to almost every day during a workweek. In HCID, the products and the process of design should derive from and negotiate its place in the everyday, based on the reasoning of Krippendorff (2006). The context of everyday in design for innovation, is an everyday where the process of design originates and the product of design is used.

Here the notion of ‘everyday’ will be further elaborated with the notions of ‘everydayness’ and of ‘everyday routines’ as an attempt to introduce a way to understand how spaces for innovation are experienced in the everyday.

According to Heidegger, the everydayness is almost always present in the natural state of being. *Dasein*, Heidegger writes in *Being and Time* (1927/2010, p. 16), shows itself “[...] initially and for the most part – in its average everydayness.”. For the most part means the way “[...] in which Dasein shows itself for everyone 'as a rule', but not always.” (ibid., p. 370). Everydayness is thus a way to be and incorporates the habitual; it is a mode of indifference and seems to be impossible to escape. The everydayness constructed of the ‘they’ [German *das Man*] is interrelated with what people usually do, the doing of what is expected. Here, the everyday routines become a part of the everydayness. Everydayness becomes a state of dispersing, a complete blend into the being of the others (Heidegger, 1927/2010 p. 126). Heidegger discusses that *Dasein* has different sides of self. The self of the everyday *Dasein*, is the ‘they-self’ where *Dasein* is dispersed in the they (1927/2010 p. 125). The notion of ‘everydayness’ and reasoning about the ‘they’ is relevant in discussions of spaces for innovation because the workspace where designers, managers, and machine operators work is a space where the ‘they’ is dominant. The ‘they’ and Schein’s (1984) definition of how cultures are created by groups as a correct way to perceive, think and feel in relation to problems of external adaptation and internal integration have similarities. But there are also differences, in Heidegger (1927/2010) the ‘they’ is not described to create cultures, but it is the way everydayness is
constructed. Everydayness is influencing the attitude to the workspace. In the use of the everyday workspace, the people experience the workspace with an attitude of indifference. Since the things people use in everyday work are so close to them, they usually overlook what the workspace is (Heidegger, 1927/2010, p. 43).

The dwelling and workspace for innovation
Heidegger (1927/2010 p. 54; 1952/2008, p. 348) describes a quality in the being-in spaces that include workspaces in the domain of dwelling. Interesting in a study on space for innovation is the thinking and the elaboration on the strong relation between existence and dwelling in Heidegger, and the possibility that workspaces can be experienced as dwellings and how. An attempt to characterise dwelling with help of Heidegger’s definition of the term is made below.

Dwelling is not just where someone sleep and live in the home sphere. In a longer reasoning, Heidegger (1952/2008 p. 348f) relate the ancient German word ‘buan’ (Swedish boa) to dwelling, which includes both a handling relation to the space and a feeling of home, growing and existence. The notion of ‘dwelling’ introduces how humans create an attitude of caring to spaces. According to Heidegger, the concept of ‘dwelling’ is connected to a dynamic relationship of staying and taking care (1952/2008, p. 350f.). Although a workspace is not a dwelling, a building for work is “[…] in the domain of our dwelling” (Heidegger, 1952/2008, p. 347). The domain of dwelling is thus not limited to a dwelling place, but can include, for example, a factory where a worker is at home (ibid.). The basic character of dwelling is to spare, to preserve, to nurture things that grow and to construct things that do not grow (ibid., p. 353). This is, according to Heidegger, a relationship to the earth, the sky, the divinities and death (the fourfold) in unity with the things: “[…] dwelling itself is always a staying with things. Dwelling, as preserving, keeps the fourfold in that with which mortals stay: in things” (ibid., p. 353).

Definition of workspace
Based on the theories presented, a definition of workspace has been developed for this dissertation. The notion of space in Heidegger’s thinking is in this dissertation contributing to a definition of space as experienced space.

The notion of workspace is used and understood as follows: Workspaces are experienced by someone who has an embodied experience of that space. Workspace can be seen as a tool and experienced with different attitudes. The workspace is a visible part of cultures that can be related to underlying assumptions in the cultures. Workspace includes the possibility to experience the embedded and recorded information and incorporates both the exterior and interior of a building and contains the entrances, facades, walls,
ceilings and floors and interior objects such as chairs, tables and coffee machines.

To conclude, in this dissertation, Bates’s information theory (2006) provides an opportunity to define space as relational and sorts out which fundamental forms of information are at play in a space for innovation. Schein’s (1984) theory of organisational culture is relevant for how the space for innovation can relate to cultures for innovation. The concepts from Heidegger’s phenomenology provide helpful notions to reason about several aspects relevant for design research when researching spaces for innovation from a user perspective.
IV. Methods

In this chapter, the methods for gathering the empirical material and methods to analyse the empirical material are presented and discussed. The chapter includes also parts of the empirical material in the description of the pre-study and of the companies.

The design research methodology (DRM) has been serving as a frame for the organisation of the research presented in this dissertation. The work process in a design research study following DRM consists of iterations between current research (to clarify the current situation of the topic), descriptive and prescriptive studies, and conclusions according to Blessing and Chakrabarti (2009), a pattern followed in this dissertation.

![Diagram](image)

Figure 5. The relations between the basic means, different stages and the main outcomes in the dissertation, framed by the design research methodology. The boundaries of the dissertation’s scope appear in the coloured background. (Modified by J. Schaeffer from Blessing & Chakrabarti, 2009).

In the research clarification stage, previous research published on the topic of innovation and space was studied. The pre-study (which consisted of the licentiate thesis and design projects) intended to increase the understanding
of spaces for innovation in the specific context of manufacturing industry (see Schaeffer, 2011, appended paper II, and section “Pre-study” below). The descriptive study 1 was based on photo-elicitation interviews, (PEIs) concerning the users’ reasoning around and experience of their workspace in relation to innovation. Besides that, shorter observations and additional interviews were made, in order to provide the context as to where the PEIs were done. Group interviews and photomaps were used to categorise and validate the material and results.

The theories from phenomenology and, culture, design and information research presented in chapter III, was used to categorise, analyse and interpret the data in the descriptive study 1. The interpretation of the results expanded the study to include an initial prescriptive study, taking form of an initial support for design and formulated as six points of departure that can be useful in dialogues and design processes for spaces for innovation. Evaluating and elaborating on the initial prescriptive study for the next stage in DRM, a second descriptive study, was not in the scope of the dissertation (see figure 5).

The different stages within the DRM, as applied in the dissertation, related to different types of design research. At least three basic types of design research: research on, research for and research through design were distinguished in publications on design research (Laurel, 2003; Koskinen, Zimmerman, Binder, Redström & Wensveen 2011 and Designfakulteten [www.] n.d.). Descriptive study 1 was related to research on design by researching the workspace as an outcome of design experienced by the user and by investigating and analysing the empirical material in relation to innovation. Its outcomes; the descriptions, the understanding and the knowledge gained (see figure 5), was related to research on design since they concern the relation to and the experience of an already designed artefact in use. The initial prescriptive study stage related to the design research for design. It allowed the dissertation to contribute to the societal discussion about possibilities in workspace design and consequences of different understandings and use of spaces for innovation. The dissertation also contained a minor area of research through design in the form of the design projects in the pre-study stage.

Research clarification
The databases Scopus, Web of Science, Libris and Google Scholar were repeatedly searched to identify relevant research publications in the research clarification stage.⁶

⁶ The search words were “‘workspace design’ AND innovation”, “‘workplace design’ AND innovation” “space AND innovation”, “spaces for innovation”, innovation AND space AND “manufacturing industry”, “architecture AND innovation”, “innovation AND production”,
Most research linking space to innovation was found in organisational and management journals, where design research on the topic was published. One challenge was to find relevant articles in design journals, which was important since this dissertation concerns workspace and innovation researched from a design perspective.

Pre-study

The licentiate thesis and the design projects mentioned in paper II, were pre-studies to the PEI-study presented in this dissertation. The results in the licentiate thesis concerned spaces for communication and continuous improvement work in industry. In the companies studied, zones for improvement facilitated the development of improvement work. The influence of a rational culture was strong. Where, how to, when, how long, what to talk about and where to place objects, texts, and people was intensely regulated in the improvement meeting zones (Schaeffer, 2011). The results presented in the licentiate thesis indicated one issue for research, of whether workspaces supporting explorative innovation could be created within a lean production environment that was strongly oriented towards controlled and regulated processes.

Attempts to study spaces for innovation were done with research through design; four projects were carried out to explore the relation between space and innovation. As one early example of such a design project, and as a motivation for the choice and direction of the Descriptive Study, one project will be presented in more detail (see also paper II).

Company 5, was a company producing parts for heavy industry. The local unit had 300 employees in 2011 (2200 worldwide). 25 employees took part in the design process. The vision in Company 5 was to create an idea workshop [Swedish idéverkstad], a space for enabling the development of ideas and a meeting between various roles on the shop floor. Company 5 initiated the project and the process incorporated interviews, visualisations, models, observation and alteration of the design in dialogue with both shop floor workers and management. Several design sketches for a space intending to introduce a less rational culture were developed together with Company 5 and groups of BA-students in Information Design. The company allocated resources, time and participated with enthusiasm in the two-year project. Company 5 took a decision to implement and construct one of the design suggestions in late 2011 (figure 6). From a research point of view, both the events in the design process and the possibility to introduce an artefact for innovation on the shop floor was interesting.

“Obeya AND production”. Various combinations of the notions ‘phenomenology’, ‘design’, ‘innovation’, ‘ambidexterity’, ‘architecture’ and ‘information design’ were also joint to find relevant research publications.
The implementation was postponed to 2013 and then to 2014. According to the dialog with Company 5, the idea workshop was not built for different reasons, economic and change of the factory layout, but was still planned for 2014 (meeting at Company 5 2011-11-22; e-mail 2012-01-02; telephone interview and e-mail with Company 5, 2013-03-18). In perspective, it was clear that the economic circumstances in the sector hindered further developments between 2011 and 2013, but that there were other influencing factors.

![Image](image_url)

**Figure 6.** One of the visualisations of the idea workshop at Company 5 in October 2011 by the Information Design students Maria Axelsson, Lina Jakobsson and Moa Norrlander. Its exterior was to be made of wooden pallets – a creative use of a material easily accessible and reusable for the company. The interior was divided in zones for more informal meetings and for information meetings, with easy access from the shop floor and visual access to the production area.

What Company 5 sought can be classified as an innovation lab on the shop floor, an interesting placement and initiative. The physical design of the space if realised, could have functioned to emphasise dislocation from day-to-day activity, eliminating hierarchy, encouraging participation as in the study of an innovation lab in Lewis and Moultrie (2005). The dialogues during the design process indicated that the users wished for spaces to support explorative innovation culture, but they had almost no support or incentive for using that kind of space in the company yet. An innovation lab depends on facilitation of the work; it is a significant investment and the lifetime of an innovation lab may be short if the support in the organisation does not exist (Lewis and Moultrie, 2005). The innovation lab may eventually be built in Company 5, but, based on Lewis and Moultrie (2005), to be a valuable investment and used as an innovation lab, it needs a facilitator, a change in culture and some rethinking of the design to function in the context.
Based on the results presented in the licentiate thesis and of the design projects, a new direction of how to and where to study spaces for innovation was developed for the descriptive study.

The descriptive study
To understand more about integrated, less costly, emergent and not easily exhaustive spaces for innovation, a possible direction in the descriptive study was to perform research regarding if and how spaces for a less rational culture already existed and could be found in the existing workspaces, without being made strategically important.

For the descriptive study, the framework of Moultrie et al (2007) (see figure 2) was redesigned to frame a study of emergent spaces for innovation in already designed artefact experienced by the user, spaces which may have been designed for a purpose and another strategic intent other than innovation (see figure 7).

Figure 7. A modified framework for identifying and evaluating emergent workspaces for innovation in the context of an organisation. The area for the descriptive study, based on the user experience, is marked out with the red box. The red box frames the actions, objects and reasoning in and on a users’ workspace, highlighting the relation between physical space, process of use, process of re-creation and the experienced meaning. (Figure content by J. Schaeffer, partly based on Moultrie et al (2007), layout by Sofia Andersson).

The new framework put focus not on the strategic intent but on the user’s reasoning and experience, in the process of use and re-creation of the workspaces in relation to innovation, wherever they may occur. Understanding workspaces as holding several emergent uses and meanings has methodological consequences that affect how a study can be famed and described. The redesigned framework takes into consideration that the original purposes
(strategic intent in figure 7) for the use of spaces may be different then a use for innovation. It does not exclude them being experienced and described as important in relation to innovation in their current use (the process of use, figure 7). The spaces are then understood differently (the experienced meaning in figure 7). The framework also takes into consideration the temporality and rearrangement of the embedded and recorded forms of information that can create spaces for innovation (the process of recreation in figure 7). The new framework allows providing feedback to the strategic level (the arrow feedback, figure 7). The redesigned framework describes the frames for a study focusing on space designed for one purpose that also can incorporate use and experience of that space supporting innovation.

The main method chosen to evaluate the relations between a physical space, the process of use, the process of evaluation and the experienced meaning from a user perspective was the photo-elicitation interview (PEI).

The companies and the informants in the PEI study

Employees from one design and innovation consultancy and four manufacturing companies participated in the PEI study.

Table 1. Companies, sectors and informants in the PEI study

<table>
<thead>
<tr>
<th>BUSINESS SECTOR</th>
<th>NUMBER OF EMPLOYEES 2012 IN LOCAL UNIT (WORLDWIDE)</th>
<th>PARTICIPANTS IN THE PHOTO ELICITATION STUDY (FOLLOW UP)</th>
<th>PARTICIPANTS IN INTERVIEWS CONCERNING THE BUILDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company 1</td>
<td>Design &amp; innovation consultancy</td>
<td>7 (8)</td>
<td>1</td>
</tr>
<tr>
<td>Company 2</td>
<td>Steel refinement</td>
<td>11 (11)</td>
<td>1</td>
</tr>
<tr>
<td>Company 3</td>
<td>Steel refinement</td>
<td>4 (1)</td>
<td>1</td>
</tr>
<tr>
<td>Company 4</td>
<td>Solutions for heavy industry</td>
<td>4 (1)</td>
<td>1</td>
</tr>
<tr>
<td>Company 6</td>
<td>Parts for heavy industry</td>
<td>5 (1)</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>31 (22)</td>
<td>5</td>
</tr>
</tbody>
</table>

All the companies shown in table 1 were co-partners in two research projects that sought to develop methods and tools to support innovation. The
companies were chosen based on their size, their maturity of working with innovation, being in the manufacturing and design context, and whether they had an interest in being a part of a research project that sought to develop methods and tools to support innovation. The informants were chosen by asking a contact person, (that already had volunteered to participate in the research projects) at each company for at least two participants at managerial level and two on the operator level to participate in the PEIs.

All the companies were, to various degrees, interested in developing a greater capacity for innovation. The design and innovation consultancy, IDEO, was chosen as a reference context to the manufacturing industrial context (see figure 8), since it has been claimed to successfully expanding as a consultancy through the systematic use of design tools and methods for innovation and has been included in Fast Company's list of the top 25 most innovative companies (Borden, 2008). Research papers on IDEO influence publications on the subject of workspace design and innovation. For example, Moultrie et al (2007) used the consultancy as an example of a company that makes strong claims about the way in which its environment and infrastructure enhance creativity and innovation performance.

Both the reputation as an innovative design consultancy and its influence on publications in the area of spaces for innovation, design and creativity (see for example Moultrie et al 2007, Doorley & Witthoft, 2012) made a relevant context case for the study. It seemed fruitful to study a well-researched company with a different method than in previous research, with a focus on users’ subjective here-and-now reflection over their workspaces, and not depend on retrospective sources. Additionally, by making the perspective of the user experience and their descriptions of their workspaces important, it was possible to have a comparable material from the two apparently diverse contexts.

Figure 8. The relation between the companies in the descriptive study. Four companies from a lean production context and a reference case from a design and innovation context.
**Company 1**

Company 1, was the design and innovation consultancy IDEO. They were working with innovation and workspaces at a strategic level and were open to participate in the study, since it was an opportunity to gain more knowledge on the subject. The Boston office was placed in an area with higher education and research, with proximity to both Harvard and Massachusetts Institute of Technology on level 4 and 5 in a five-story office building (field notes by author, 2011-10-27 and 2013-02-06). The whole building had almost 37,000 m² of office space and IDEO used two-fifths. The building dates to 1926 (I 1.3). The entrance of the building was from the sidewalk of Massachusetts Avenue, through a glass door.

The building’s interior was renovated in 1986 and in 2008. The two floors that accommodate IDEO were renovated to meet their needs in 2007 (I 1.3). Before the renovation, floors 4 and 5 had no interior connection with each other, a stairway between the two floors to facilitate communication and movements through the floors was installed in the renovation (I 1.3). The reception area was surrounded by an open plan office space, a kitchen and smaller workspaces separated from the office by glass walls. The fourth floor was mainly the designers’ area and had a lounge area, project spaces, a workshop, a photo booth and a room for office supplies.

The PEIs were done in collaboration with seven informants (one director, two designers with more than 20 years’ experience in the company and four designers with less than two years in the company) in October 2011. Verbal interviews were conducted one and a half year later, in February 2013, to present the results and validate the categorisation and the analysis of the results.

**Companies 2, 3, 4 and 6**

In the studies in the four manufacturing companies, Companies 2, 3, 4 and 6, 24 participants were involved between 2011 and 2013. Nine participants worked on the managerial level and 16 on the operator level. All these participants worked in production or were connected to production. Companies 2 and 3 were chosen because they had recently started to implement lean production and were interested in both incremental and radical innovation. They were also examples of small companies delivering parts and providing service to other companies and of companies whose production facilities are not in close proximity to their customers. Companies 4 and 6 were chosen because they had standardised ways of working, with continuous improvement being their way of improving production. These companies were parts of multinational concerns. Management in all four companies had an interest in how workspace design could support improvement work and innovation. None of the studied companies had an innovation lab, an *obeya* or other strategically dedicated spaces for explorative innovation in proximity of the
workspaces studied. The buildings housing the four companies’ production units are located to industrial areas in south and mid-Sweden.

Company 2

Company 2 was a SME that was located in an industrial area outside a city centre. The company had both product development and production in their facility and the company was relevant to incorporate in the study since they had challenges both when it came to be innovative in how to produce their products, how and where to communicate with different costumers, and what to produce – in order to meet the needs of their changing market and the competition from other companies. Two years before the study started, the company had begun to work with implementation of lean production and was interested in several ways to develop this work further, including workspaces that support innovation.

The entrance of a brown brick, three-story building faced the street. The facilities of the factory were most of the informants worked were reached from the office building through a double door. The PEIs started in the office building; and the informants spread in the whole building. Storage dominated the factory facilities. In the neighbourhood, there were several smaller workshops and industries. In the 1960s, the building housed a mechanical workshop. Later it was developed into a small company handling metal and during the time of the study it was delivering services and products related to metal handling.

Company 3

Company 3, a SME that worked with metal handling had both product development and production in their facilities and had recently started to implement lean production and apply 5S. This company was relevant to incorporate in the study since the company had a relative short experience of lean production compared to the other companies, but their position as a subcontractor to various companies had created a motivation to become more innovative in order to reduce costs for the production and to find ways to “stay in business” (I 3.3). The company moved to its premises in an industrial area located outside the city in 1998–1999. A building constructed in 1963 was on the site. The interior was “blown out” in 1999, and interior and exterior renovation was done (I 3.3). The building was given a new façade and an addition was made to the factory, making the building L-shaped. The brown brick exterior bound together the old and new parts of the factory. Around the building, a fence with barbed wire framed the premises. There was a locked gate in the fence, and a phone used to ask for entry. The entrance led to a stairwell. Upstairs, there was an open office plan, a meeting room where the PEIs started and the office of one of the owners. The production area was in an adjacent one-story building connected with the offices by a stairwell.
Company 4

In Company 4, a multinational company, the interviews took place in a part of their Swedish plant. Lean production was used in the production unit since long and the company was interested in how the production unit could be further developed with the help of visual tools that could support innovation. There had been on-going discussions within the company about how to create a supportive environment for improvement work since there was a drive to improve not only production, but also to improve the improvement work.

The company produced specialised products and solutions for heavy industry. In the 1970s, the plant moved to an industrial area outside the city centre. The factory consisted of several buildings; the main one was two stories and had a brown brick façade and hangar-like production units with walls of corrugated steel and bricks; built in the 1970s. The entry way had double doors and one has a door telephone for admission. The PEI started in closeness to where the informants worked, both in the offices and conference rooms that were in the brick building; and in one of the several hangars for production that were adjoined with the office building at the ground floor. There had been several initiatives to renovate the interior both in the office building and in the production unit between 2000 and 2010.

Company 6

Company 6, a multinational company producing parts for heavy industry, had worked with lean production for over 10 years. The company was interested in developing the use of space and visualisations to further support their efforts to be competitive. The PEIs took place in a Swedish plant, built in 1980s (I 6.1). The building housing the workspaces studied had a flat roof and a brown brick façade, a gate and fences surrounding the entrance. The workshop was located on the ground floor and offices on the second and third floors. The dominant spaces were open, housing production, offices, storage units, and meeting spaces with whiteboards. The informants worked in the production unit and the engineering offices and the PEIs started in closeness to where the informants worked.

The method of photo-elicitation interview and its application in the descriptive study

The photo-elicitation interview (PEI), which is an interview method from ethnography (Ball and Smith, 1992), appeared to provide an opportunity to gain knowledge of how users experienced and reasoned about their workspaces as spaces for innovation and the values and assumptions behind that reasoning. Ethnographic methods have been increasingly used in design research, and since the 1970s the methods have been applied in HCD practice (Koskinen, 2011; Rose, 2012). Design ethnography has been utilised in
participatory design projects to provide understanding of users’ values and experiences (Ylirisku and Buur, 2007). It has also been used to understand “the particulars of daily life […] to reduce the probability of failure [in design] specifically due to a lack of understanding of the basic behaviours and frameworks of consumers” (Salvador, Bell & Andersson, 1999, p. 37).

A common approach to put visual methods into practise in research is to introduce a photograph that the researcher has made or to use video to capture processes and behaviours (Scherer Cohan, 1992; Collier, 2001 and Epstein, Stevens, McKeever & Sylvain, 2006)). The fundamental idea in photo elicitation is to insert a photograph taken by a researcher into an interview. Since the PEI study was seeking to learn which spaces the users experienced and described hindering or supporting innovation, a different approach was needed. In the variation of the PEI developed for companies 1, 2, 3, 4 and 6, the participants were given cameras and instructed to take photographs of their workspace. The decision to let the participants take their own photographs was motivated by the importance of letting the informants’ experience of, choices of and thinking around workspaces for innovation come forward. When informants were asked to take their own photographs, to be used in an interview, this method is called photo self-elicitation (Harper, 2002) or auto-driven photo-elicitation (Samuels, 2004). PEI in this dissertation is used as an abbreviation for the photo self-elicitation interview.

The choice of PEI was also grounded in a theoretical perspective of the interlacement between space and space experience. A phenomenological study is here understood as being based on a philosophical direction moving from a Cartesian separation of body and mind to an investigation of an embodied experience of space, an interweaving of the body, mind and things. In phenomenological studies, ethnographical methods are often used but the phenomenological studies aim to go deeper incorporating the embodied experience to elaborate generalisable patterns, structures and meanings, according to Seamon (2000). The PEI provides one possibility to communicate with users about workspaces and parts of workspaces they experience and describe as supporting and hindering innovation. Here, ‘experience’ and ‘describe’ is used to frame the involvement with the workspace in relation to innovation as coming forward in the interview. Building on Heidegger (1927/2010) the workspaces are understood within experience that is based in a ready-to-hand relationship to the workspaces. ‘Experience’ as used in this dissertation, draws towards the meaning of ‘sensed’ or ‘felt’, where the whole body senses the environment. The experience is also influenced by earlier experiences, and social factors. Those experiences of workspaces were within the PEI described with help of photographs and words. Based on previous research using PEI, the description of the experience can to a certain degree tell about how and what influences the users understanding of the workspaces. The method has earlier studies shown to result in emotionally rich descriptions of experience of space (Venkatraman & Nelson, 2008).
There are differences in the quality of the interviews between those using photographs and text and those using words only. Collier (1957) and Samuels (2004) both made comparative studies of word-only interviews and PEI. They argue that PEI provides much richer descriptions than word-only interviews and that the answers could be considered as more relevant to the interviewees because they appear to have more bearing to their everyday life and work.

A pilot-study of the PEI was done in 2011 with 5 participants in Company 5. One important goal was to develop the question that should be asked during the interviews and to direct the PEI. The PEI in the participants’ own workspaces was finally formulated as two requests (in Swedish for the Swedish participants), read out loud by the researcher in the beginning of the interview and also written on the instruction sheet that was handed out at the same time (see appendix 6). They were:

1. Think about physical environments or parts of environments at your company that, from your perspective, support innovations! Photograph five of them.
2. Think about physical environments or parts of environments at your company that, from your perspective, hinder innovations! Photograph five of them.

No other instruction was given. Most of the participants found motifs they wanted to photograph within 30 minutes and ended up with 10 photographs.

Figure 9. Parts of the PEI process. From left to right: Encouraged by the requests, the participant photographed spaces that were considered as supporting or hindering innovation and wrote comments about them. The photograph was then viewed on a screen or printed out and used as reflection material in individual and group interviews. (Illustration J. Schaeffer. Photograph inserted in the illustration made by I. 2.6)

Each photograph had several possible readings. The researcher’s interpretation was neither relevant or given in the interviews. Therefore, the participants wrote down what they had photographed and added five key words for
each photograph during or immediately after the photographs were taken (see appendix 6). Immediately following the photography session, recorded interviews took place. The photographs were transferred to a computer to be viewed on the screen or in printed version during the interview (see figure 9).

The photographs, the keywords and two questions: “What did you photograph?” “Why?” structured the main part of the interview. The interview ended with the question: “What is innovation for you (there are no correct answers)?” The relevance of these questions both for the informants and for the research results, is further discussed in the section “Investigating a phenomenon meaningful to the informants” below.

Often the first two questions did not have to be asked because the answers emerged naturally when the participant and researcher started to look at the photographs. Few questions were used to make the answers rich; the interviews also made it possible to clarify answers regarding the motifs, two ways to have good quality of interviews, according to Kvale, (1997).

For internal documentation, the material was coded with an informant number and company number, which were only traceable to an individual through an informant-code key document. (The latter was created to be able to exclude material if the interviewed person later wished to withdraw from the study.) The original files and the interviews were thus treated with confidentiality. In the code, (I) stands for informant, the first number stands for the company and the second stands for the individual informant in the company. The goal was to be thorough in the data collection, to record every interview in order to not distort what was said, this follows Kvale (1997).

**The analysis**

The motifs played an important role in structuring the analysis of the rich interview material. Earlier studies using PEI discussed the possibilities of using the method in an interview situation where it provided an opportunity within the interview to do an emerging analysis of the material (Jenkings, Woodward & Winter, 2008). In step 1, the motifs structured the individual interview. The participants interpreted the photographs one by one during the interviews, and clarifications could be made. It was possible to take more time for a certain motif and to go back and forth. In step 2, the motifs and the keywords from the interview structured the clustering and helped to select relevant parts of the recorded interviews. During the analysis, the author listened to the interviews, targeting sections about the content of the photograph. The workspaces that users experienced as supporting or hindering innovation, was grouped based on the user’s description of their photographs, to give an overview of the material. In step 3, the clusters showing the motifs in groups were shared with the informants in Company 1 and 2.

In Company 2, a team analysis of the material was made in a group interview. A reason for the group interview was to analyse the material with the
informants in a group setting and to have an opportunity to validate the clustering of the motifs. It gave the participants an occasion to share the motifs with each other, (which was a wish from the participants) and was supported by the interest from management to discuss the workspace design with the employees.

An advantage of a group interview is that participants will feel more relaxed, since existing groups can take part. Recording equipment does not often disturb the interviewees. But there are also known problems; some participants may not find the courage to speak, and it is hard to know who is speaking on a recording of a gender-homogeneous group. The researcher has to both be a good listener and to moderate the interview (Wibeck, 2010).

A form of a two-dimensional photo-map inspired by Collier (2001) served as a guide for the conversations. All the photographs and the keywords were printed out and arranged anonymously on two walls in a conference room (see figure 10). The model for the photo-map was structured around different clusters for example, “scrap hindering innovation” or “storages supporting innovation”, which were based on descriptions in interviews and the keywords from the participants describing the spaces. The first 15 minutes of the group interview were dedicated to studying the clustering of the motifs and comment on them. In this way, the group interview was used to validate the clusters described in paper III and to have the participant’s opinion on them. These maps opened the opportunity for examining details in the whole material and discuss several motives and their content, which was observed to happen in the group interview.

Figure 10. Photo-map in the room for the group interview in October 2011, Company 2 (left). The placements of the posters in Company 1, 6 February 2013 (middle) and on 7 February 2013 (right). Photograph by J. Schaeffer (left, middle) and I 1.6 (right).

At Company 1, a similar organisation was used to validate and provide opportunities to discuss results from the individual interviews made in October 2011, with the participants and all the users of the office in Boston. The pho-
Photographs were arranged on seven posters, where a few photographs represented one cluster, for example “open spaces supporting innovation”. Several participants’ keywords related to a motif were blended and presented with a photograph of the space made by one of the participants. The results were arranged in a way to preserve the confidentiality of participants’ as much as possible. The posters were mounted on portable display in their office during the visit at IDEO in February 2013. Figure 10 shows the two different placements. The interviews were structured around spontaneous reactions on different subjects for discussion introduced, such as: themes being missing, rearrangement being needed, the relevance of the material, finding different themes, and thoughts around strengths and weaknesses of the method from a user perspective. The interview was semi-structured, in that subjects for discussion introduced to the groups, but the structure changed depending on the answers. Spontaneous discussions about what to do with some spaces seen as hindering innovation occurred in both Company 1 and Company 2. The feedback from the participants was that the motifs shown were in line with what they could remember wanting to talk about.\(^7\)

The theories were also used for the analysis of the PEI study. Bates’ (2006) “Fundamental Forms of Information” and the definition of ‘communication space’, which were introduced and published in the licentiate thesis (see the appended paper I), continued to be one of the theoretical perspectives supporting the analysis in the descriptive study (see the appended paper III). While analysing the results of the PEI study, it became clear that the understanding of the microelements of doing, moving, and living in the spaces are not provided in the theory of Bates (ibid.). That is why reasoning form the culture theory of Schein (1984) was introduced in paper III and phenomenology in paper V and the dissertation cover essay. The additional perspectives allowed for an expanded theoretical base to describe, discuss and analyse the relation between humans, a workspace, and a photograph of a workspace and innovation in the descriptive study. These additional theoretical perspectives contributed to contextualise the forms of information and to defining space in relation to the user, in greater depth. A methodological difference form paper I, informed by the expanded theoretical perspectives, was introduced in the descriptive study. In paper I, the workspaces were analysed by the researcher with help of Bates (2006) forms of information. In the descriptive study, informed by the phenomenological perspective, Bates (2006) forms of information were used to categorise the empirical material from the PEIs, i.e. the informants’ particular reasoning and experience of their workspaces.

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\(^7\) David Kelley, (I 1.8), the founder of IDEO, did not take part in the PEI in 2011, but gave feedback on the material in 2013. In paper III there is a print error that may confuse the reader (I 1:7 was mistakenly referred to as I 1.8 on page 57 in paper III.)
Characteristics of explorative innovation for the analysis

An analysis of visual material is usually not stronger than the strengths in the categories because the categories themselves contain the substance of what is investigated (Ball and Smith, 1992). This was true for the first analysis of the material presented as clusters in paper III (see also table 3 and table 4 in chapter V). In order to analyse the empirical material for paper IV, characteristics from previous research on explorative innovation were brought together to do an analysis that could answer the research question: “How do the relations between users, workspaces and different innovation cultures take form?” Since the spaces are a visible part of the culture (Schein, 1984) and innovation cultures are an aspect in assessing innovation capability (Björkdahl and Börjesson, 2012), formulating characteristics of an explorative innovation culture was one way to find motifs that correlated to a certain type of innovation within the material from the PEI (see table 2). The motifs that had indications of an explorative innovation culture in them as described below were chosen, analysed and interpreted (see paper IV, table 5 and following sections in chapter V). This analysis was done to learn which motifs and the users description of them that could be related to characteristics of explorative innovation in the material from Company 2,3,4 and 6. The characteristics were used generously to not exclude any motif.

Table 2 Characteristics created to analyse the empirical material to find occurrences of motifs with connection to an explorative innovation culture

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>Ekvall (1997); McLaughlin, Bessant and Smart (2008); Peschl and Fundneider (2012)</td>
</tr>
<tr>
<td>External input/Weak ties</td>
<td>Chesbrough (2003); McLaughlin, Bessant and Smart (2008); Oksanen and Stähle (2013); Turner and Lee-Kelley (2013)</td>
</tr>
<tr>
<td>Informal communication</td>
<td>Ekvall (1997); Dixon (1999); Allen and Henn (2007); Moultire et al (2007); Fayard and Weeks (2011);</td>
</tr>
<tr>
<td>Risk taking</td>
<td>Ekvall (1997); McLaughlin, Bessant and Smart (2008); Peschl and Fundneider (2012);</td>
</tr>
<tr>
<td>Play/Improvisation</td>
<td>Leonard-Barton and Swap (1999); McLaughlin et al (2008); Fayard and Weeks (2011)</td>
</tr>
<tr>
<td>Incubation</td>
<td>Leonard-Barton and Swap (1999); von Stamm (2008); Fayard and Weeks (2011); Peschl and Fundneider (2012)</td>
</tr>
<tr>
<td>Permission</td>
<td>Ekvall, (1997); Fayard and Weeks (2011); Peschl and Fundneider (2012)</td>
</tr>
</tbody>
</table>

*Called ‘dimensions’ in paper IV
The characteristic of ‘openness’ directed the search for motifs and descriptions in the material related to trust, since a strong level of trust creates opportunities and ideas, and allows opinions to come from all the employees (Ekvall, 1997). Indications of an openness to let patterns, ideas and rules emerge over time and to have a loosely structured organisation mentioned by McLaughlin, Bessant and Smart (2008) were also chosen as an approach for the search. Motifs and descriptions showing attitudes, values, and practices of openness, an openness to observe and to listen to weak signals, an openness to radically question habits and themselves, to (re-) learn, to listen and to observe closely (Peschl & Fundneider, 2012) were included as motifs characterised by openness.

‘External input/weak ties’ means using bridging ties and looking outside the close social network to search for new knowledge supporting innovation (Chesbrough, 2003; McLaughlin, Bessant & Smart, 2008; Raisch et al, 2009 and Turner & Lee-Kelley, 2013). Any indication of relations outside the close social network to search for new knowledge in a motif made it relevant for a closer study. External input included a search for motifs showing external inputs concerning the experience of the physical space based on findings on the relation between the design and experience (Oksanen & Ståhle, 2013 and von Krogh, Ichijo & Nonaka, 2000).

The characteristic of ‘risk taking’ involved a search for motifs and the descriptions of them showing a tolerance for uncertainty and ambiguity, rapid decisions and actions, and/or concrete experimentation since it supports innovation as described by Ekvall (1997) and McLaughlin, Bessant and Smart (2008).

To find motifs and descriptions of the characteristics of ‘informal communication’, any indication of informal communication creating opportunities for new ideas as put forward by Dixon (1999) and Allen and Henn (2007), trust and cooperation as put forward by Fayard and Weeks (2011), and opportunities for clashes between different ideas, experiences, viewpoints and knowledge in a heterogeneous combination of participants support innovation as presented by Ekvall (1997) and McLaughlin, Bessant and Smart (2008) were given attention.

The characteristics of ‘play/improvisation’ focused the search in the material on indications of discovery and experimentation, building on others, co-creating prototypes, spontaneous and relaxed atmosphere and divergent thinking since it is pointed out in previous research to create a culture for explorative innovation (Leonard-Barton and Swap, 1999; Ekvall, 1997 and McLaughlin, Bessant and Smart 2008).

Motifs chosen for the category of ‘incubation’ in the material were motifs describing radical ideas given room to develop as discussed by von Stamm (2008) and space for people to reflect individually and in group as discussed in Leonard-Barton and Swap (1999), Fayard and Weeks (2011) and Peschl and Fundneider (2012).
The characteristics of ‘permission’ focused the search in the material on indications of permission from management to make contacts, give and receive information, discuss problems, take initiatives of different kinds based on Ekvall (1997), Fayard and Weeks (2011), and Peschl and Fundneider (2012).

Initial prescriptive study

The aim of this dissertation was to describe how users experienced and reasoned about workspace and innovation, but the intention, following the DRM, was also to inform designers, managers and others interested in how spatial design can support innovation in a initial descriptive study (Blessing & Chakrabarti, 2009) (see figure 5).

In this dissertation, the suggested initial support for design was based on the knowledge gained in the analysis and the interpretation of the material from the PEI study. The empirical basis of the outline for the support for design is limited and the support should be viewed as a suggestion and a fuel for discussion, and not a fully tested support for design, building on the reasoning of Kjørup (2009) where interpretation can give birth to a discussion that places the humanities in the current debate.

Method discussion

Several methodological questions are relevant to discuss in relation to an interview study, and especially to one that uses photographs to study users relation to workspaces and innovation.

The PEI study tried to do justice to the specific reality that the participants related to. The goal was to be responsive to contradictions and ambiguities and to not exclude any themes in the material. This means that the results can be perceived as ineffective and detailed. However, the results strive to be close to reality and from this perspective, are reliable, a perspective on reliability put forward by Bengtsson (2001). From a phenomenological perspective, the world is particular (sensual and situated) and general (has meaning) (ibid.). When the PEI method was used, the goal was to recognise sensual and situated experience and find what can be said to be common. To balance between the particular and situated experience and the meaning that can be generalised from the material has been a challenge.

Investigating a phenomenon meaningful to the informants

The motifs presented, analysed and interpreted in this dissertation were based on what came forward in the interviews. This brings out two critical aspects towards the PEI study.
Firstly, since the study strived to do justice to the specific reality that the informants had a relation to, one could question if the study was designed to be relevant to them. Secondly, also because of the fact that the study strived to do justice to the specific reality that the informants had a relation to; one could question the motifs relevance in relation to innovation. These two aspects will be discussed below.

To have good quality in an interview, the phenomenon investigated has to be meaningful for the informants, as pointed out by Lantz (1993). The request initiating the interviews was formulated to allow for an understanding of the users’ understanding and experience of their workspace. The request directed the interviews towards the “physical environments or parts of environments” at the company that, from the perspective of the employee, supported or hindered innovation. The formulation was considered, on the base of the pre-test, to be open enough to the informants interpretation to not exclude the possibility of receiving answers that involved innovation as well as physical space. Judging from the motifs, the relative openness gave certain liberty in what to photograph. It was an issue in formulating the request, where for example ‘ideas’ could be a word more relevant to the informants, but did limit the results in regard to innovation. Although ‘innovation’ could be perceived as a word with distance from the informants’ world, after pre-testing, it was considered as the appropriate expression to use, balancing the relevance for the informant and the aim of the PEI study.

On an organisational level, there was a meaningfulness concerning spaces for innovation. At IDEO, the core in the business activities concerned innovation and to work with spaces was a part of the strategy. At the four manufacturing companies, the management saw innovation as a part of the strive to improve production and a motivation to be as good as possible on all areas in order to survive. On the individual level for the shop floor workers, one can question the level of relevance of the word ‘innovation’, especially since ‘innovation’ was a concept that was not discussed much in the production units studied. But the informants did photograph motifs, supporting and hindering their understanding of innovation and their answers show that the interviews gave time to reflect over and describe what innovation and spaces for innovation was for them.

This discussion, of the investigated phenomenon relevance for the informant, leads to the question of bias. When a phenomenon is difficult to define, as for example spaces for innovation, it is common to use a structured open interview that seeks answers based on how the informant perceived the problem according to Lantz (1993). The method has to have a certain balance between investigating motifs that informants would not naturally have found without instructions and ‘leading questions’. All questions are leading, according to Kvale (1997), who suggests that instead of discussing that, it is important to see if the question is productive and provides openings to a subject. The request to photograph environments supporting or
hinder ing innovation in the instruction exerts an influence before the informant takes the camera and searches for spaces for innovation. In this view, the request becomes intertwined with the here-and-now embodied perception of space; together with historical, cultural and social experiences. Earlier experiences can become active in the perception situation. The results of the method used could be criticised for not showing spaces for innovation, since it did not take in consideration whether or not those spaces described by the participants from the manufacturing industrial companies are related to any outcome of innovation. In contrast to a retrospective study on spaces for innovation, this here-and-now oriented PEI study, focused not on the outcome of innovation but on the innovation cultures in the company that is the postulate for creating capabilities for innovation according to previous research (see for example Peschl & Fundneider, 2012).

As mentioned in the introduction of this section, the strive to base the study on the informants perspective opens for another criticism of the PEI study, since it intentionally implies that the informants could define innovation. One may ask what a motif presenting a new machine that was described as efficient really has to do with innovation and not just efficiency, and in that say that the results should be meaningless in relation to innovation. One can instead argue that the motifs and answers are coming forward because they are meaningful and relevant for the informants in relation to innovation. The use of photographs showed an understanding of the word ‘innovation’ from the particular experience on micro-level, close to the everyday life and in use. In order to answer the criticism, it was important that this particularity is the point in a phenomenological study, and gave a possibility to understand more about the participants’ way to describe innovation and spaces for innovation. Additionally, the answers and the understanding of the spaces photographed were analysed in relation to the different definitions of innovation presented in previous research. The comparison showed that it is not only in the minds of the informants that efficiency, for example, could be related to innovation; this notion also relates to innovation defined as exploitative in previous research. Empirical studies combined with the theory, as used here, is a form of abduction. Abduction as described by Alvesson and Sköldberg (2008) is a way to discover new patterns when the empirical material and the theory are interpreted in the light of each other. The answers form the informants were one result that was fruitful in themselves, but the abduction used in the analysis of the results of the photo-elicitation study compared the answers to previous research on innovation, reinforcing the relevance of the study in relation to innovation. In abduction, it is also common for the interpretation from one case to be strengthened by several other cases (ibid.). The interviews from five different companies strengthened the interpretation.
The description, confidentiality and representation

With the phenomenological perspective in mind, and also in line with ethnographic research tradition as described by Wolcott (1999), the choice was made to observe all the occurrences of photographed motifs. Even if a motif was rare, the phenomenon was experienced by the individual and existed in relation to cultures, and is in the analyse and interpretation of the material seen as being as valuable as a common motif.

The clustering of motifs in larger groups was done as carefully as possible – but some of the clusters hold more ambiguities than others (see paper III and also table 3 and 4). The point of the clusters was not to present the results as quantitative data. It was an attempt to visualise the particular motifs in a slightly higher level of abstraction in the material from the manufacturing industrial companies and the design consultancy.

What have not been discussed in the papers were the different levels of resolution of motifs in the clusters. The decision to include all the motifs ranging from a chair to a whole production unit in a cluster, was additionally motivated by the definition of space used here. Objects, texts, images and whole interiors are interlaced in the descriptions of a space for innovation. Because the participant had the power over the description and the chosen motifs, the power over what is described can be said to be distributed more evenly than in an interview where the researcher takes the photographs that are the starting point for the interview. In the moment of the PEI, as used in the study presented in this dissertation, the researcher did not present her own view, neither about which spaces were interesting nor how to take the photographs. The interviews became an opportunity for understanding and discussing what was represented in the photographs with the basis in the users’ understanding and experience.

The role of the researcher in relation to description of the spaces for innovation has been different in different stages of the study. In the PEI, the phenomenological perspective implies that the spaces are described on the base of someone’s experience, and the role of the researcher was to create an interview situation where the users’ experience and reasoning came forward. In the description of the company buildings made by the author, to contextualise the PEI, the exterior was included in order to give a complementary context of the results of the PEI, giving another seemingly objective perspective, which was conflicted from a phenomenological theoretical standpoint. One could question the relevance of that perspective for the PEI study even though it gives a description of the different companies.

As discussed above, during the PEIs and the first descriptions and analyse of them, the attitude to the employees’ experiences of spaces for innovation was characterised to be open to what emerges from the material, as pointed out to be important in a study from a phenomenological perspective (Seamon, 2000). The choice was to use a method that limited the influence of the
researcher’s pre-knowledge and allowed the informants’ experience to rise, as described by Seamon (2000), in a “rich, unstructured and multidimensional way” (p. 163). With that said, in designing the questionnaires for the interviews, and in the analyses of empirical material for the study, it was not possible to avoid the researcher making some impact on the results and descriptions. For example, the requests directed the interview, had an impact on the interview situation and thus on the descriptions. It was also possible to miss important themes in the material in the analysis, due to blind spots in understanding the contexts. To expand the knowledge base from design research, as made within the kaikaku research project, a seminar series were created with the aim of studying the relation between innovation, design and production with researchers from all three areas. In this series, the whole group sought to gain an understanding of the ideology behind lean production and its relation to innovation. Those inputs were important to understand the context for the study from a research perspective.

Another criticism of the PEI study is that examples in the manufacturing industry of SEIs may not have been photographed; in other words, the method used may have missed description of important spaces for explorative innovation. However, even if more spaces for explorative innovation did exist in the companies, they did not come forward in the material. To use the notion of thought worlds as defined by Dougherty (1992), the interpretation of the results indicates that an employee in a thought world dominated by the central idea or action of exploitative innovation does not view SEIs as having meaning in relation to innovation and the dominance of examples of spaces supporting an exploitative innovation culture was strong. It can be noted, that repeating the same study in manufacturing industries having a well-developed use of innovation laboratories or other dedicated spaces, which were not included in the study, may show interesting results that could be compared with the results presented here.

The circumstance that the interviews started in the interiors of the companies and how the question was formulated, can have limited the results. All the photographs in the PEI, except the two of a car, are from inside the building so the photographed motifs and the spaces experienced and described as important in relation to innovation are limited spatially to the interior of the workplaces. The method combined with the question showed motifs that were close to the body in the participants everyday work, things that were known from practice. Thus, there was also limitation in the reframing and reflection on where workspace for innovation may be located, that could be achieved in the way the PEI was conducted here.

The issue of what was described also points to difficulties of knowing whether there is an individual experience of the workspaces and understanding of innovation, as well the cultural forming of the understanding of innovation, or how the two are intertwined. The assumption was that the participants’ experience of the workspaces and their relation to innovation would
come forward in the keywords and interviews since the things found in photographs are “conditioned to the cultural knowledge the viewer brings to the viewing” as Ball and Smith (1992, p. 18) formulated it in the book *Analyzing visual data*. The answers would be influenced by the accord in the culture. The experience is filtered by, and a part of, what is expected in the culture. In the group setting, the spaces supporting or hindering innovation are discussed and visualised, and in that reveal what is acceptable to say about innovation in this public/private sphere of the company. It could be expected that the company culture and the work task would influence which spaces the informants experienced and described as supporting and hindering innovation. This was also the main pattern in the material. It is important to note that there were individual variations in the material, and the PEI as a phenomenological method contributed to also bring in the individual variations in the empirical material, the discrepant data from the manufacturing industrial companies.

To be able to publish photographs of the workspaces and still preserve confidentiality was a challenge. Many precautions were taken to protect informants’ identity especially in the smaller companies. For publication, the photographs also had to be modified. If the company name or a person was visible, it was blurred or masked. The description of the informants in the papers and the dissertation cover essay and the description of spaces to give a context to the conditions for a PEI, was brief since it was problematic to include photographs of workspaces and at the same time try to preserve the confidentiality of the informant. Anyone who had been inside the company could have recognised which company was being discussed, and the informant could be identified by position, age and/or gender. Some descriptions could also be potentially sensitive for the company, which is why the confidentiality of the informants had to be ensured internally and externally to the extent that was possible.

The introduction of a photograph used instrumentally in an interview, then published in a research article, can also be potentially problematic for the company. The photographs were not made to sell an aestheticised environment. They were used instrumentally to find spaces that were believed to support or hinder innovation and the users’ relations and their understanding of these spaces in relation to innovation. One could argue that it would have been better to not publish the photographs, and in retrospect, that would have been a possible solution.

To critically review the papers to have a more valid empirical material, it would also have been better to keep the design consultancy confidential. It is not easy to say how this issue affected the responses from IDEO. The efforts to preserve the informants confidentiality were described at the beginning of the interview. Since IDEO promoted openness and the choice was to publish the name of the company, and since the informants were aware of that in beforehand, the research, one can presume, became a part of storytelling.
The results were possibly less rich, and so the publications and the deeper analysis of discrepant motifs from the design company were omitted. Several cases from the design and innovation consultancy context would also be needed to make a deeper analysis meaningful of what is a common experience of space for innovation in that context.

One lesson learnt was that confidentiality is important for a PEI, both on individual and on company level. It was still useful to bring the context case of IDEO into the study to be able to study whether there was a consistence between the answers or not from the two contexts. It gave a possibility to compare the material and analyse the differences. The validity of a study can be strengthened by combining different groups of respondents as discussed by Kvale (1997).
V. Results and Analysis

The results presented in this chapter are based on the results presented in the appended papers. This chapter provides first a short presentation of the papers and then an overview of the results from the PEI in the manufacturing companies and the innovation and design consultancy. Then follows a comparison between the results from the two contexts with an analysis of the results in each section. Thereafter are the results on the exceptions of the material from the PEI in the manufacturing industrial companies presented, analysed and interpreted. Lastly, six areas as an initial support for design are presented.

Paper I, was called “Design as information. How may information and design relate?” (Andersson, J. & Andersson C., 2008). This journal paper presented results on the early attempts to bring together the information theory of Bates (2006) with design practice, and was included in the licentiate thesis.

Paper II, “Spatial design supporting the management of radical improvements”, (Schaeffer Andersson, J., & Jackson, M., 2013) was a conference paper that presented results on the visualisations and prototypes made in the pre-study. It also presented a preliminary model suggesting a spatial support for radical innovation.

A journal paper, paper III, “Spaces for innovation. A Photo-elicitation Study in Three Companies from Manufacturing Industry and the Design Firm IDEO”, (Schaeffer, J., & Eriksson, Y., accepted 2013, published 2014), presented results in an overview of the empirical material from the photo-elicitation study in companies 1, 2, 3 and 4. Paper III clarified the differences between manufacturing industry and the design and innovation consultancy in the results. In paper III, the perspective of innovation in research was presented, but not developed in depth. The analysis in paper III was limited in this aspect. In paper IV and in the thesis cover essay, this perspective was further developed theoretically towards the coexistence of different innovation cultures.

Paper IV, “Tool-complexes of innovation”, examined spaces for explorative innovation (SEIs) in the results of the PEIs (Schaeffer, J., & Eriksson, Y., 2014). It included an analysis of the empirical material and developed a perspective towards coexistence between two different innovation cultures. Motifs with traces of an explorative innovation culture were presented and analysed. This paper included results from Company 6.
Paper V, “The method of photo-elicitation from a phenomenological perspective”, (Schaeffer, J., & Carlsson, A-L. (2014) was a conference paper that discussed the photo-elicitation interview (PEI) method from a phenomenological perspective. In the thesis cover, the results of the PEI are further analysed and interpreted with the basis in the theory first presented and used in paper V.
Spaces described to support or hinder innovation

The result show which spaces the users described to support or hinder innovation and how they reason about them, in the material from the PEI in the manufacturing companies and the innovation and design consultancy. The presentation starts with motifs from the industrial manufacturing companies.

The industrial manufacturing companies

With 24 participants from the industrial manufacturing companies, the PEI study ended up with 216 photographs with motifs described by the users as spaces supporting innovation or hindering innovation. The motifs and interviews showed the understanding of innovation as exploitative.

Table 3. Visualisation of the motif clusters of spaces that the users described as supporting or hindering innovation in companies 2, 3, 4 and 6.

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8 Since the overview of the results from Company 2, 3 and 4 (paper III) has been published separately from the results from Company 6, (that were included in the analysis of the material in paper IV), the material from Company 6 is included in table 3 to give an overview of the whole material. The numbers in table 3 is therefore not in accordance with table 1 in paper III.
The majority of the motifs showed workplaces, machines and tools, whiteboards, meeting places for continuous improvement work, storage and scrap. There were fewer examples of spaces for spontaneous meetings, entrances, graphical material and people and few metaphoric photographs. The following sections present and discuss the motifs that represent the main characteristics in the results from the manufacturing industry.

**Workplaces**

During the interviews, operators and engineers on the shop floor named one sort of motif “workplace” [Swedish *arbetsplats*]: “my workplace”, “a workplace” or “the workplace” describing a space for assembly or for refining a part that would later be produced (for example by I 2.3; I 2.5; I 4.1; I 4.3, I 6.2). For participants in managerial positions, the notion of ‘workplace’ was used for their offices or spaces they considered a substitute for offices (for example by I 4.2 and I 3.3). 24 of 51 workplaces were experienced as supporting innovation. The dominant pattern in the workplace cluster, experienced as supporting innovation, is the description of an orderly workplace. Keywords connected with photographs of orderly workplaces were related to cleanness, orderliness, waste reduction, and ergonomics.

![Figure 11. Workplace at electronic assembly described as supporting innovation, Company 2. (Source: Photograph by informant 2.3.)](image)

In figure 11, the photograph presents an example of an orderly workplace in an electronic assembly department. This space is described to support innovation because it is experienced as ordered and clean. It is a space where order saves time and the cleanliness ensures the quality of the technical processes. Informant 2.3, who photographed this workplace was an assembler.
hired at Company 2 in 2007. Informant 2.3 defined innovation with the words “new thinking”, “create new” and “future”. The keywords the informant connected to this physical environment were “airy”, “light”, “clean”, “order” and “good-looking”.

Workplaces described as hindering innovation (27 motifs of 51) can be divided into two groups: workplaces that were experienced as messy and workplaces that were experienced as hindering communication. The messy workplace was the dominant motif and was described with keywords related to disorder, waste and dirtiness.

**Machines and tools**

When machines represented new technology, they were a part of the workspace considered to support innovation. These machines were characterised by words such as “new”, “amazing techniques”, “security”, “no limit”, “fascinating”, “future” and “makes it possible to earn a lot of money” (I 2.1; I 2.2; I 3.2; I 3.4; I 4.3; I 6.2 and I 6.4), all words with connection to production improvement and possibilities.

In addition, words as “clean”, “order”, “speed”, and “simplicity” were mentioned (I 2.1; I 2.2; I 2.6; I 2.8; I 2.10; I 3.2; I 4.3; I 4.4 and I 6.4). There were also comments covering the experience of working with a new machine, such as the feeling of pleasure working with new technology.

![Figure 12. Machines experienced as old and ineffective, described as hindering innovation. Photograph by I 4.2.](image)

Old and ineffective machines were considered as hindering innovation (see figure 12). The keywords describing the photographs of those spaces with machines hindering innovation were, for example, “hard to work with”, “frustration”, “time thief”, “museum”, “worn out”, “unusable”, “demands a
lot of space”, “boring”, “dirty”, “sticky” and “smells” (I 2.1; I 2.6; I 2.8; I 2.9; I 3.2; I 3.4; I 4.3; I 6.3; I 6.4 and I 6.5).

Storage
The informants considered orderly storage (Swedish ställages) to support innovation, because it made tools and materials easy to find. There were 15 examples of storage units supporting innovation in the material. They all were variations of the motif shown in the example from informant 4.4 (see figure 13). Order was described to contribute to efficiency, with the experience to give a clear view, uniformity, and accessibility (I 2.3; I 2.4; I 2.5; I 2.6; I 2.8; I 3.4, and I 6.4). Those storage areas were characterised as “work-friendly”, “attractive” and “making the user proud of the result” (I2.3; I 2.4 and I 2.5). The unordered storage was considered to not support innovation because it resulted in a lack of space, disorganisation and hindrances (I 2.3; I 2.6; I 2.8; I 4.2; I 4.3; I 4.4; I 6.2 and I 6.4).

Figure 13. Orderly storage unit described as supporting innovation, Company 4. Photograph by informant 4.4.

Scrap
The only cluster that was not described as supporting innovation was scrap (see figure 14 for an example). Seventeen photographs showed scrap, wasted material and garbage in the production units. Informant 3.1, a newly hired logistics worker in Company 3, took a photograph of an environment with pallets, and wrote: “Unstructured setting up/handling is obstructive in all levels, pallets scattered all over is as bad as ‘to do’ post-it around the computer screen, lack of structure ☹”. (Written comment during PEI, I 3.1]. Keywords to describe the experience of those photographed spaces were: “unstructured”, “difficult to work with”, “garbage place”, “rubbish collection
location”, “old crap”, “save or discard”, “discomfort” and “more and more” (I 2.1; I 2.2; I 2.5; I 2.6; I 2.9; I 3.1; I 3.2; I 3.3; I 3.4; I 4.4 and I 6.3).

Figure 14. Scrap described as hindering innovation. Photographed by I 2.5.
The design and innovation consultancy IDEO

In the results from IDEO, 84 photographs and 7 interviews were the basic empirical material. The main motifs for spaces that support innovation were displays and graphical material (to showcase exciting things), open spaces for informal and planned meetings (such as the kitchen), and project spaces for teamwork. The photographs were mainly of motifs that showed the informants related spaces as supporting or hindering innovation to an understanding of innovation as explorative.

Table 4. Visualisation of the motif clusters of spaces the users described as supporting or hindering innovation at IDEO.

Photographs of spaces at IDEO considered to hinder innovation included storage areas with leftover computers, working materials packed in boxes, spaces that were impersonal, not well planned, and without any special character (see table 4).

Open spaces for planned and informal meetings

14 photographs out of 22 show open spaces for planned and informal meetings with motifs such as an espresso machine, a kitchen, a foosball table, a picnic table, an open table, lounges, a shared breakfast in the office kitchen/café. This embedded form of information was described as supporting innovation (see one example in figure 15).
The café was described as an open and social space, experienced as the centre of the studio, where colleagues often meet and share food. The café was described as a community meeting spot, where running into people and chatting was experienced as a key for creativity (I.1.6). The lounge was used for a change of space when needed. Informal meeting places were described, for example, as “lively”, “homey”, “noisy”, “fragrant”, “inviting”, “communal”, “togetherness”, “nourishment”, “low-pressure”, “sharing”, “non-committal”, “fun”, “relaxing”, “competitive”, “teamwork”, “sporty”, “collaborative” and “humble” (I.1.1; I.1.2; I.1.3; I.1.4 and I.1.5).

Some informal meeting places were described as hindering innovation; three photographs were of the downstairs lounge and two of the IDEO café area. They were experienced as “ignored”, “bland”, “lifeless”, “forced”, “exposed”, “non-integrative”, “noisy”, “uncomfortable” contribution to “separation” and “distraction” (I.1.1; I.1.2; I.1.3 and I.1.5).

The open and collaborative spaces dominated. Spaces for incubation did not come forward. There were no such places in the design of the office because such spaces were considered to be found anyway. If people needed silence they could leave the office for a while (I.1.8).

**Project spaces**

11 photographs out of 16 showed project spaces supporting innovation (see one example in figure 16). Project spaces were seen as a unit for production at IDEO. The project’s spaces were described with notions like “personalisation”, “customisation”, “flexibility”, “familiar”, “community” and “common
ground” (I. 1.4; I 1.5; I 1.6 and I 1.7). The negative aspect of project spaces occurred when too many people shared a space, thereby failing to provide room for personal items or ideas to live (I 1.4; I 1.5 and I 1.6), or if the users did not have time to bring in interesting objects (I 1.2).

Figure 16. Project space described as supporting innovation with its community feeling (I 1.4). Photograph by informant 1.4.

Display and graphic material

14 photographs out of 16 from IDEO show displays and graphical material supporting innovation.

The informants described these forms of embedded and recorded information with words such as “fun life”, “interactive”, “interesting”, “art”, “original”, “casual”, “informal”, “fresh”, “entertaining”, “different”, “generous”, “telling”, “hi-tech”, “low tech”, “showcase”, “inspiration” and “expressive” (I 1.1; I 1.2; I 1.3, I 1.4; I 1.6 and I 1.7). For example, visual objects on display, described as supporting innovation, are shown in figure 17. It is a special “tech-share” and was described by informant 1.4 as a “place where everyone can go and share things, and where both low-tech and high-tech items are accepted” (see figure 17).

Concerning the display of objects and graphical material, the descriptions of the motifs show a permission to build on what others had started, when creating different sorts of displays and visual inspiration. As an example of that, a close up of the same motif as shown in figure 16, was used to describe visual objects supporting innovation by informant 1.6. Informant 1.6 said, “Teams are invited to enhance the spaces, and here we see the yellow chandelier from a previous project layered with tea bags from a current team” (I 1.6).
The descriptions of the motifs showed that use of visuals and graphical material was conscious and important in creating spaces experienced as supporting innovation. Additionally, the informants had the words to express themselves concerning their relations to the artefacts.

Figure 17. Visual objects on display described as supporting innovation, Company 1. Photograph by informant 1.6.
Comparison of the results in the two contexts

Despite the imbalance between the numbers of companies from the two contexts (one design and innovation consultancy and four manufacturing companies), it is fruitful to a certain extent to study the differences and similarities in the results in order to gain knowledge about workspaces and different cultures’ understanding of them, and also to learn what seems to be common and different in relation to what is influencing the experience and description of a workspace as a space for innovation.

Multimodal experience and multi-layered descriptions

One of the similarities in the results from the manufacturing companies and the design company was that PEI allowed for variations in the descriptions of the same interior space, with different angles of interpretation of the photographs.

In the reflection over the photograph of a workshop described by Informant 1.5 as supporting innovation, it was also possible to discuss aspects that hindered innovation. In addition, in the descriptions around the photographed examples of the spaces, a multimodal experience of the spaces and its influence innovation came forward. An extract from the interview with Informant 1.5 will be used as an example:

I 1.5: Yes it’s two people in there for the moment and again its messy; its loud, its energetic, its bright; it’s one space we can go and be focused … and turn on music and again you are making things and there is natural lights coming through that window so… The other workshop does not have that natural light. You get a sense of; at least you get a sense of, where you are in the day, and if you are sculpting, it’s nice to have natural light shadow. And I just have a lot of good memories of that space because you are always on a mission when you are in there. […] There are qualities about that space that are less than ideal but

JS: Aha, on the other hand…

I 1.5: Yes, it is a mess. I used to manage that shop and now someone else does it so the whole “feng shui” is all off in my opinion.

JS: Yes…

I 1.5: I set it up differently, and now it is kind of amusing and annoying at the same time when something is not in the place I think it should be.
In the interview, the photograph brought forward reflections about the workshop’s energy and liveliness, the mission, the organisation that support innovation. The informant also describes a multimodal experience of space. His answer incorporated different experiences: other human beings, the sense of hearing (music, loud noise), the sense of touch (making, sculpting), the sense of seeing (light, shadow, messy) feelings (energetic, amusing, annoying, focus, being on a mission), connection to the exterior (sense of time of the day), past experiences that influence the here-and-now experience (good memories, order).

The multimodality in the experience of workspaces also came forward in the material from the manufacturing industrial companies. For example, Informant 4.2, an engineer made the photograph of a corridor (see figure 21). While talking about this photograph, the informant described a negative inner state of mind related to the experience of this part of the workspace, and emphasised that a space that is dark (no windows) and dirty and where you feel lost is not a space supporting innovation.

In three photographs of spaces from the manufacturing industrial companies the motifs chosen were spaces used as a metaphors to illustrate the informants’ thoughts about the experience of the organisation and innovative work efforts. It gave a possibility to discuss different views on innovation, and accentuated the relation between spaces and human absence or presence and the effects in the workspace. In one example, “disengagement” (I 2.4) was represented by a photo of an empty chair in the conference room of Company 2. This use of photograph of a space for innovation should be compared with the user in the material presented above, where, for example, the participant represented what he or she described as orderly storage supporting innovation with a photograph of an orderly storage.

During a group interview, the participants discussed the photograph made by informant 2.4, who responsible for ordering materials for production:

I 2.4: It’s a chair; it’s an empty chair. Unengaged personnel, they are not present.
I 2.7: This is your place then?
I 2.4: No it is not my place. It is a chair that symbolises …
I 2.7: … that the person is on a meeting?
[laughter]
I 2.4: No but, in fact not present; he or she does not want to be engaged in new thinking … and it works to present that.
JS: Is it a symbol of how you can be absent, sometimes?
I 2.4: Yes, I think that it’s about being absent.
I 2.11: but another word might be non-involved.
I 2.4: Yes, that’s right.
I 2.11: Not physically absent but…
I 2.4: Exactly.
JS: I can imagine that this chair can, of course, mean that you are really committed, too, that you are out somewhere and work. But that’s not the way you…?
Multiple voices: No! Then you are engaged in things that you should not be engaged in.
[laughter]
I 2.11: It is not given, that this is the case
I 2.4: No. But you are unengaged in…
[---]

The discussion was about openness to think in new ways – and a contrast to “stay on your spot”. Another theme in the discussion was that it’s not meaningful if you are physically in the workspace, but are not mentally present.

The photograph served as a way to create and share a common as well as a divergent understanding of the relationship between the immaterial and the physical space, and of the notion of engagement in relation to innovation in work. The immaterial space and its relation to the material space both concern spaces for innovation on a micro level. The results show similarities in the multimodality in the responses to the question about spaces and innovation, and the possibility to nuance what in a space supports or hinders innovation. The results also show that a photograph of a space was used to share describe and develop the understanding of innovation. Another similarity in the result was, that the PEIs did not allow for many motifs of workspaces supporting or hindering innovation outside the building.

There were also differences in how the same sorts of motifs were understood in the two contexts.

Order, storage and scrap

One difference between the two contexts formed around the motifs of storages and machines. Storage and scrap were seen solely in terms of hindering innovation at IDEO, in contrast to the manufacturing industry, where scrap and unorganised storage were described as hindering innovation and orderly storage described as supporting it. In the manufacturing companies, when things were considered as easy to find they were also thought of as making production efficient, which then made the orderly storage an artefact in a culture of exploitative innovation. This was the case, even when the material was in boxes (see figure 14). When it came to the workshop at IDEO, order in the workshop seems to serve another purpose in the manufacturing industry. According to informant 1.5, an efficient environment should facilitate being in flow, preserve the feeling of flow and for that purpose allow someone to quickly find all the tools and materials in the workshop. In that way, order and efficiency can make imagination and ideas come to life, according to informant 1.5. However, in the design consultancy, the motifs of storage were understood as things hidden, not visually accessible and thus considered to hinder innovation. At IDEO, orderly storage was seen as too enclosed, allowing no visual access to the content. For example, closed cup-
boards and a slick corporate look were seen as hindering innovation and so was work material in boxes (I 1.1; I 1.3; I 1.4 and I 1.5). In the IDEO culture, spaces described as supporting innovation should not be experienced as hiding their treasures, not be too orderly and, at the same time, provide the opportunity to remain in the flow or in other words, give a possibility to remain in the ‘ready-to-hand’ relation to the things.

What is happening here can be interpreted by bringing in the notion of ‘tool’. Heidegger (1927/2010) presented three ways in which a ‘tool’ can become unready-to-hand, and one way is when a part is missing so a tool cannot function. This way for a tool to become unready-to-hand is called ‘obtrusive’. In relation to the findings from the interviews (I 1.1; 1.4 and 1.5), the material hidden in boxes and behind corporate looking cupboards hinder innovation since they hide a vital part of the tool, to expanse the interpretation; a part important for this tool in use becomes missing, its visibility. Here, the part of workspace described as hindering innovation is a tool that is experienced as unready-to-hand since what is should be used for was hindered.

As presented above, Informant 1.5 at IDEO appreciated the lively workshop, but said it was too messy. He said the whole “feng shui” in the workshop was gone. But order and efficiency stand for something else at IDEO and are connected to nuances different from those found in the descriptions of motifs or order from the manufacturing industry participants. At IDEO, there was sensitivity in answers about order, mirroring a culture of explorative innovation, with openness, exploration and playfulness. The answers showed a delicate balance between the freedom to adjust the workspace and to preserve order, which should not be too strict. In the motifs from the manufacturing industry, good order was supporting innovation, since it was in line with 5S, and there were no descriptions indicating nuanced attitudes towards order.

**Graphical material and displays**

Another difference between the empirical material from IDEO and that from the manufacturing industry was the number of photographs of displays and graphic material and their connection to innovation. The recorded form of information was understood as important to innovation at IDEO. At the manufacturing industry, the 6 examples of the graphical material was described as a support for innovation since it was structured information boards and visualisations supporting the work to control and communicate the improvements in small steps. At IDEO, the word or concept associated with this form of embedded information was not “order”; in contrast, the motifs were something that triggered imagination, fun or interesting items coming from outside.
Artefacts and different innovation cultures

At first glance, the motifs that employees photographed as spaces supporting or hindering innovation may seem to have little to do with innovation. These motifs included new and old work equipment, orderly and messy storage spaces, coffee rooms, toilets, project spaces, and workshops. However, experienced workspaces are filled with meaning for the people working in them. In the production units studied, the assumptions and the culture of exploitative innovation strongly affect the design of the factory and other workspaces. In the design company, the empirical material also shows the correlation between the company culture and the artefact.

The embedded information and the recorded information, for example the motifs of machines from the manufacturing industrial companies and the graphical material from IDEO were described by the users as important in spaces supporting or hindering innovation, and how they are described show they are meaningful to people in relation to innovation. In the manufacturing companies, the embedded form of information, for example, orderly storage areas and orderly workplaces were mentioned in relation to innovation. The users described qualities in the artefacts as being important, such as new, easy to overview, structured, efficient and clean. It shows the closeness between the ready-to-hand experience to the motifs chosen and that they are made meaningful in how they were used in work. The motifs were artefacts related to everyday work, and were experienced and described as artefacts important for innovation with most examples that can be related an exploitative innovation culture. At IDEO, which had dominant examples of explorative innovation culture, the recorded information was described as more important than it was in the manufacturing industry, but also shows a dominance of spaces that stimulate informal communication and group work, adjusted by the needs of the users. How people acted, what they said and how space was designed were interrelated in the understanding of a space as supporting or hindering innovation. These results are in line with the research by Nonaka, Toyama and Konno (2000) and their concept of ‘ba’, considering both the tangible and the intangible aspects of a ba important for innovation.

At IDEO, the answers to the question “What is innovation for you?” ranged from a 5-minute response to a 20-minute argument. One informant talked about innovation at work as a way to be able to change the world (I 1.6). Another informant explained that the word innovation means nothing for him – it is the design process itself that is an innovative approach, leading to an innovative product or service (I 1.1). Their points of view were more directed to understanding the notion of innovation as explorative, and design thinking as inspiring innovation.

These results indicate that at IDEO, the informants were trained in their professions to talk and think about innovation. Their definitions of innova-
tion and the descriptions of the motifs showed examples of openness, external input, play/creativity, informal conversation and permission, as presented as characteristics of explorative innovation by March (1996), Peschl and Fundneider (2012), Ekvall (1997), McLaughlin, Bessant and Smart (2008), Fayard and Weeks (2011) Dixon (1999), and Turner and Lee-Kelley (2013). In IDEO, there was a conscious effort to support explorative innovation with help of space, both strategically and in its everyday use. For example, during the workweek, the café and lunch space has personnel to cook breakfast and food for special creative exercises (I 1.5). The kitchen area was also described as an informal community meeting spot, and the users know that it was a space that could be used to run into people and chat – experienced as a key for creativity (I 1.6). Spaces for face-to-face communication were numerous. Displays showed inspirational “fun stuff”, opportunities to bring in other thinking and ideas in the design unit. The opportunity to have spontaneous meetings to support innovation was also formalised by the non-demanding informal breakfast meetings in the kitchen area and by the placement of people together in project spaces. The attitude to space included a freedom to cultivate one’s own work environment, to alter spaces to facilitate meetings and project work, and to create one’s own space for incubation when needed. The design of spaces communicated possibilities rather than a regime of control, forced change or routines. The photographs showed a variety of motifs, with spaces balancing proximity, permission but less of privacy, the three notions put forward by Fayard and Weeks (2011) to support innovation.

Drawing on the theories in previous research on ambidexterity (Raisch et al, 2009), it would have been expected from the successful growth of IDEO more motifs related to an exploitative culture. From both the IDEO designers’ and manager’s perspective, the choice of motifs and the descriptions could be influenced by a strong mission in the company culture to deliver a storytelling of design thinking and innovation, and that the understanding of innovation as explorative excluded motifs of spaces representing exploitative innovation culture. On floor 5, personnel working with strategies, economy and sales occupied the open space offices but their workspaces did not figure in any motifs, not even from the manager, Informant 1.3. This part of the company could be expected to work with continuous improvements in processes, balancing the exploration and radical innovation with an exploitative innovation culture, but that perspective was not found in the results of the PEI. One reason could be that the choice of informants was limited and did not well represent the diversity of the company, since they were designers and a manager (although not with a background in design).

The material has not been thoroughly analysed, with the focus on exceptions from the majority in the material from IDEO, because of the limitations in the methodology. Still, it was clear that in the material from IDEO, based
on the motifs and the descriptions of them, that the spaces supporting or
hindering innovation, are artefacts in an explorative innovation culture.

The reasoning around the photographed spaces from the manufacturing
industry indicated a notion of innovation as exploitative innovation, even
though some motifs also included elements of explorative innovation. In
their work, the informants from the manufacturing industrial companies
strove to refine and revise existing products or services: they were trained in
lean production thinking, in how to do incremental innovations based on
continuous improvement. Consequently, they also took photographs of their
work environment that supported signs of an efficient lean production. In the
introduction, theories about the meaning of unspoken roles and how they
might affect the working space were mentioned (Schein, 1984). In the mate-
rial, relationships between a certain qualities in the photograph of a space
and how the informant understood them in relation to innovation were de-
scribed. For example, the way informant 2.3 defined innovation was as “new
thinking, create new and future”. The key words connected to the orderly
workplace described as supporting innovation were an experience of the
workplace as “airy, light, clean, order and good-looking”. How can innova-
tion described with the words “future” and “new thinking” be related to
cleanness? The key words and the definition of innovation can be understood
in the context of lean production practice. With an unordered, dirty produc-
tion area, the company will not be effective enough to survive in the future.
To think in new ways is to think according to the 5S-tool implemented and
lean thinking, showing an understanding of innovation as exploitative.

In the industrial companies studied, most of the spaces that are described
to support innovation were those that support 5S, order, and efficiency. Most
of the spaces that are described to hinder innovation are those that hinder 5S,
order, and efficiency. Concerning the pattern in the motifs from the manu-
facturing companies, the majority of motifs chosen as spaces for innovation
were supporting the realisation, in different steps, of lean production. The
material shows that there is a dominant culture of exploitative innovation in
the manufacturing companies studied. The dominant exploitative culture
(with 5S as part of the culture) forms both the production design and the
relationship to things. In practice, it allows for the dominance of external
rules for placement of artefacts and the location and occupation of the peo-
ple. Drawing on the reasoning of Schein (1984) where artefacts are one of
the most visible elements in a culture, the few SEIs that are coming forward
in the material then are artefacts in another culture than the dominating ex-
plorative innovation culture. From a thought world dominated by an explo-
litative culture, it is difficult to perceive spaces for explorative innovation as
meaningful (Dougherty, 1992). That is why the descriptions of from the
manufacturing industrial companies that could be related to a culture of ex-
plorative innovation were interesting to study in greater depth.
Spaces and explorative innovation in the manufacturing industrial companies

One interesting result of the PEI study was the motifs from the manufacturing companies that related to the characteristics of a culture of exploration. The motifs that did not show motifs related to exploitive innovation, helped to answer the question of how the relation between users, space and different innovation cultures take form.

Motifs with characteristics of explorative innovation

In the empirical material from the manufacturing companies studied, the 216 photographs, 1075 keywords, and 24 interviews, 12 motifs were found, which had a relation to characteristics of a culture of explorative innovation (see table 2). In total, these 12 motifs reflect 34 of the 216 photographs.

The analysis cannot be said to be exhaustive but the goal was to find motifs and the descriptions of them with indication of openness, risk taking, external input, informal communication, improvisation/play, incubation and permission into consideration for a closer analysis (see table 5). Those motifs were found among those described as hindering as well as supporting innovation.

The motifs found had connections to one or several characteristics of explorative innovation. The motifs were coffee rooms, an aquarium, an “illegal” meeting place, a spontaneous conversation beside a machine, the production area at night, a lounge, a telephone, cars, an office unit in an engineering department and one in production, an invitation to a Christmas party, an empty reception area, boring conference rooms and corridors.
Table 5 Motifs with characteristics for explorative innovation in the material from the manufacturing industrial companies

<table>
<thead>
<tr>
<th>Motif (amount of photographs)</th>
<th>Openness</th>
<th>Risk taking</th>
<th>External input and weak ties</th>
<th>Informal communication</th>
<th>Improvisation and play</th>
<th>Incubation</th>
<th>Permission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee room (11)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Illegal meeting space (1)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Aquarium (1)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Lounge area (2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Beside machine (2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Production at night (1)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Telephone (1)</td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Car (2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Office unit (2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Christmas party invite (1)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Empty reception (2)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Corridor / boring conference room (10)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Motifs related to informal communication
The coffee room motif occurred in empirical data from workers on the shop floor and the managers. The motif of coffee rooms included both enclosed spaces dedicated to have a coffee and coffee machines on the shop floor.

In the interviews, the coffee room was described in a way such that it matched the following characteristics of explorative innovation: openness, external input /weak ties, informal communication, incubation and permission.
The motifs of the coffee rooms had close placement near production and were described to offer openness, spontaneity, and opportunities to talk about work or other subjects. On the shop floor, the coffee room was a “common meeting place for all different functions and roles” (I 6.1). Informant 6.1 worked with the teams on shop floor as an internal consultant for improvement work in the manufacturing company. The informant had been working at the same company for more than 20 years as shop floor worker and in management positions and thus knew the company and his co-workers for a long time. A reoccurring characteristic in the description of the coffee spaces on the shop floor was “spontaneity”, a spontaneity that concerns what to talk about, and the possibility of finding the people there. It is spontaneous in contrast to the fixed times for improvement meetings or activities when working with continuous improvement.

In Company 3, a newly hired logistics worker, informant 3.1, also chose to take a photograph of a coffee room. He talked about innovation as “problem solving”, “frictionless flow”, “optimisation” and “doing things right away”. He expressed a rational view of working life in production, a working life disconnected from the parts of life that includes feelings, thinking and actions that do not immediately pay off economically.

When talking about the motif of the coffee room (see figure 18), he also talked about another side of life, which he described “the soft side, about feelings and experience … about our existence” (I 3.1). He portrayed the coffee room as the source of reflection and thinking – and he said that the

Figure 18. Coffee room experienced and described as supporting innovation, Company 3. (Source: Photograph by I 3.1.)
reasoning could support innovations. He mentioned “relaxation”, “caffeine”, “reasoning”, “team spirit”, and “safety”. Twelve employees used this place to have a coffee on the shop floor. In the interview, Informant 3.1 said this place gives a “home” feeling because it acts like a home base for the team and provides a feeling of safety.

Informant 4.2, who also worked on managerial level in production in Company 4, talked about “relaxation”, “community”, “sharing thoughts”, “joy” and “comfort” in describing their coffee space, a table within an open office space in a unit of production engineers.

There was no coherence in the material or colour scheme in the embedded forms of information, the furniture were of various colours, material and age. Thirteen production technicians and Informant 4.2 used this space.

Informant 4.2 said that it was a comfortable space, and it was interesting to sit down and listen to the discussions, and that he learned a lot about what was going on. He said that when this part of the office was used for breaks, it was a giant forum for ideas. He described the space as follows:

I 4.2 It is the fact that you move from your [computer] screen. It is a feeling of leisure time in some way. The nice feeling of comfort makes the people around the table to come up with a half-weird idea that you never dare to take up at a meeting. If you don’t have a sound ground for your idea at the meeting you may choose not to open up. But in these circumstances, there are higher tolerance and greater feeling of security.

In Company 6, there was one example of a coffee room that was combined with an improvement meeting area in order to loosen the routines of the improvement meeting described by Informant 6.1. The first motif shows a meeting place near the assembly line that is intended to support innovation regarding the work on the assembly line (see figure 19). The informant described this as an “improvement meeting”. A group of people had chosen the place and the furniture for themselves. The informant said, “By choosing furniture and place before the meeting has started, it helps [us] to think in a creative way and that provides [the] possibility of then entering into the subject of the meeting with open senses” (I 6.1). The informant thought that the space supported innovation because it was possible to be spontaneous and said that the space did not have “an already habituated behaviour” (I 6.1). Because the meeting took place close to the production area, a group could easily get materials to illustrate what they want to say in order to find new ideas and solutions. Informant 6.1 chose also to take another photograph of another meeting for improvement work. He did so, because the comparison, according to him, created opportunities for analysing his work environment, by taking the photograph in two different spaces and with two different groups. Improvement work was explained as a process of continuous improvements, driven by the workers in lean production (I 6.1).
The second example showed an improvement meeting in which management had assigned the place and furniture. During the interview, the informant said: “If the space [...] is limited in itself, and you yourself cannot influence anything, I think that the meeting becomes limited” (I 6.1). Limitations are defined as “being located away from the production area”, the “meeting being habitual”, a space “assigned by management”, and a space being “un-interesting” (I 6.1). The informant also commented on people’s movement patterns in the room, stressing that this space already had a “pre-learned behaviour or use” (I 6.1). For example, everyone had a place where they usually sat. Additionally, he said, they did not have closeness to the material in production that could be needed in the meeting.

When writing keywords and talking about the situation represented by the photograph, the informant connected to the moment when he made the photographs, to the physical space, the people, the action, and the thinking in the company about meetings. He also reflected on the differences in the two spaces depicted, for example, the source of the objects in the spaces. He commented on the placement of the meeting space (in proximity to or at a distance from the production area) and the objects facilitating discussion. He made connections between the freedom to organise space and freedom of thought and habits (patterns of body posture and movement that he described constrained the possibility of thinking innovatively).

The informant reflected on the formal and informal leaders as he studied the location of the people on the photograph: who was standing where; who “owns their chair”; the look in the people’s faces. The informant commented
on the network of power influences, on what is possible to do, to think and to say during the meeting. The two photographs elicited thoughts about power and leadership and its effects on improvement work.

Informant 6.1 opened up a discussion of the balance between the exploitative and a more explorative culture in a combination of improvement meeting and a coffee break at the shop floor. The improvement meeting structure in the company usually has a more exploitative culture with clear agendas, structures, and goals that are visually followed up and time controlled. But in the “space in the space” there is an attempt to redesign the improvement meeting within an improvised space. The redesign is an example of an attempt to open up for a coexisting explorative innovation culture within the exploitative culture.

A few other motifs could be related to informal communication, improvisation and play and/or incubation. For example, the invitation to the Christmas party and the aquarium connected to keywords about “positive feelings”, “appreciation” “work friends”, “time for reflection” and “problem solving” (I 3.3; I 3.4; I 4.3 and I 6.3). Another example showed two operators standing in front of a machine discussing a problem with the machine. Informant 3.4 said that there was a possibility, depending on the physical closeness of good work friends and machines, to communicate, to find new solutions and to solve problems. Even though the definition of innovation as problem solving shows an understanding of innovation as exploitative (I 3.4), the description of the motif of the meeting beside the machine also shows that there was spaces with a possibility of creating an open trustful and incubative environment which are understood as important in relation to innovation. Peschl and Fundneider (2012) and Fayard and Weeks (2011) put this forward as being important for explorative innovation. The motifs shown provide opportunities for informal communication, which is also supporting explorative innovation culture (Dixon, 1999; Allen & Henn, 2007 and McLaughlin, Bessant & Smart, 2008).

**Motifs related to external input**

A few examples of spaces were described in a way that could be connected to external input: a telephone conversation, corridors, a reception area, and cars. The few examples could be a consequence of where the PEI started and how it was introduced to the participants, as discussed in method discussion. But it could also indicate what was considered as workspace for innovation from the perspective of the participants, which is the line of thought followed here. Almost no informants photographed motifs outside the factory premises, indicating that their understanding of where innovation was supported or hindered was mainly inside the factory building. External input is important to develop new ideas because it bridges ties to the external world and allows for access to diverse and new knowledge (Raisch et al, 2009). The motif of the reception was photographed by a warehouse worker at
Company 2, who had been working there more than 10 years (I 2.1) (see figure 20).

![Image](image.jpg)

Figure 20. Entrance and reception area experienced and described as hindering innovation, main entry to the left in the photograph, Company 2. (Source: Photograph by informant 2.1.)

The reception area was a small space immediately to the left of the entryway to the building, a placement that made the reception area slightly hidden. It was easy to pass by without noticing it. Visitors and costumers from external companies or organisations had to pass through this area when entering the building. On the day of the photograph, no one was working in the reception area. In the opinion of informant 2.1, the area did not support innovation, because it did not take care of the relation to the costumer. “This is an empty reception; here I thought that when you come in, you expect someone to meet you there; but I don’t know, it was just a thought…” [The informant sounds unsure, as if it was not possible to bring up this kind of perspective in the interview]. Encouraged by the feedback of some positive humming, the informant continued and said this was the first impression people had of their company: it was black, the light was out and it was empty.

Some descriptions of motifs combined external input with incubation and permission. Informant 3.3, the owner of Company 3 and the production manager, said he thought about new ideas for production at night or when he drove his car. The production at night was a space for ideas because it was not so stressful as during the day. He described the car as a good place to come up with new ideas because it was comfortable, had music, and took him to new places. There was also a sense of acceleration, and he had time on his own.
Informant 4.2 also took a photo of a car, a motif connected with external input, openness, incubation and informal conversation. He said a car was a good place for two people to discuss solutions without being disturbed. They could talk calmly, discuss solutions and come up with new ideas.

I 4.2: For me it is a really good way to take the car, something starts rolling, it is a movement and … I don’t know … focus … you becomes focused, you have no one else to take care of for the moment, undisturbed, you are away from work, it creates a distance. You cannot do anything about what is happening at work right now. If I sit here with you right now, maybe something is happening outside, then I must interrupt the conversation and leave, this part is wiped away.

He continued to describe his thoughts about impressions from the external world and how it was related to thinking.

I 4.2: Impressions, things that you see when you are driving, I have a hard time to explain it, but I can feel it when I am in the car. You drive by something and it activates a thought. I don’t know. Impressions that activates some kind of idea-hormone in the head. It starts something more than in here, with these walls. I know exactly, nothing happens. When you go by car or by train, I think that is a really innovative environment, to sit in a car and travel.

Two photographs, (from two different companies and photographed by informant 4.2 and 6.2) illustrated the corridors in the production units as hindering innovation because they did not allow for external input, improvisation and play which, in the view of the informants, created new thinking. Informant 6.2 described the environment as the “alley of sighs”, a boring environment that had nothing to stimulate new thoughts. He commented on the square forms in the production area of all the storage units and passages and said “design of production tells you to be square and to work, work, work”.

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To summarise, I 4.2 and I 6.2 talked about several relations to the motif of the corridors described as hindering innovation in the production units, and one perspective was that they were not stimulating and did not allow for external input. Informant 2.1 was not sure the reception area really had something to do with innovation. Still, the informant chose to photograph it as hindering innovation, referring to external relations to customers and called the experience of the entrance “dark”, giving an impression that it was not open to visitors and customers.

In the case of the motif of the car and the motif of production at night, the interviews revealed that stress made external input hard to handle in the office and production area during the day (I. 3.3). Being in a car provided time for reflection, incubation and a balance between internal and external input. The car becomes a refuge where new places, music, and comfortable seating could lead to new ideas, in the descriptions from both informants.
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Figure 21. Corridor experienced and described as hindering innovation. (Source: Photograph by I 4.2.)

The informant 4.2 described the photograph of the corridor (see figure 21) like this:

I have not really thought about that much, but then when I went around and looked […] it hit me. Here, I have never been, I have never been, I’ve never gone in here. […] It is only as a blank gap, which is dark. […] I get a feeling of sadness because of the dark and dirty. Negative thoughts hinder the ability to see innovation. No window. […] I feel lost and then the endlessness. For me, this is very distracting if I should try to think of something. There is no start or stop, no beginning or end, there are no references. And for me it’s hard when I do not have any references. […] I think it creates more anxiety […]. I just want to come out here somewhere, so it’s not an innovative environment, I believe […].

To summarise, I 4.2 and I 6.2 talked about several relations to the motif of the corridors described as hindering innovation in the production units, and one perspective was that they were not stimulating and did not allow for external input. Informant 2.1 was not sure the reception area really had something to do with innovation. Still, the informant chose to photograph it as hindering innovation, referring to external relations to customers and called the experience of the entrance “dark”, giving an impression that it was not open to visitors and customers.

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formant 3.3 and 4.2. The car with its enclosed structure that can accelerate to new places provides a space the informant did not find within the factory. Its movement away from the factory suggests that there was a need for a physical separation to get into another mode of thinking.

The example of being in the production area at night was not a link to external input, but did illustrate a spatiality where external input from humans in the social network of the daytime was reduced. It provided an opportunity for incubation and reflection.

Motifs with characteristics of risk taking

One example that could be related to risk taking was found, a motif that informant 6.1 called an “illegal meeting space”. It was a table and some chairs in the production unit in an unapproved space. The informant said it was a place “without expectation”, it was “spontaneous”, “illegal”, had no restrictions in the sense that “you are not expected to deliver, so then you deliver [ideas]”. The production unit was in a highly standardised company that set the rules for the placement of things. Having everything in its place is an important way to see things in lean production, which is dominated by standards and rules. Here the rules for placement were being violated and in the thought world of the informant the space became “illegal”. This space, which was created on the users’ initiative, forced itself into the dominant exploitative culture because it was neither approved by the management, nor taken away (1 6.1).

Users, workspaces and different innovation cultures’ coexistence

The 12 motifs from companies 2, 3, 4 and 6 showed some characteristics of an explorative culture, which was interpreted as indicating that the culture was strongly oriented to exploitative thinking in those companies. This means, in line with Schein’s (1984) definition of culture, that the underlying assumptions that the group has developed in relation to their work and workspaces has proven to work well enough to be considered valid and be shared among the members of the group. When there are indications of a culture that holds, for several reasons, assumptions that are considered less valid and are not shared as much among the members of the group, as the 12 motifs presented in the sections above, the motifs and the reasoning around them is here argued to belong to a marginalised culture. The examples of spaces, that had an relation to an explorative innovation culture were interesting to analyse from the point of view of ambidexterity, because they indicate how two cultures could coexist, despite the two having different basic assumptions about what was considered valid. An analysis of the way in which the coexistence was described by the informants would possibly make the relation between integrating and separating explorative and exploitative innovation cultures come forward. Below the 12 motifs concerning an explorative culture are further analysed and interpreted.
Categories of spaces for explorative innovation

One of the main results in the dissertation was the emergent spaces for explorative innovation culture found within the material from the manufacturing industry presented above, and the analysis and the interpretation of them as six categories of space (see figure 22).

Figure 22. Six categories of space for explorative innovation (SEI) based on the 12 motifs that had indications of an explorative innovation culture within the lean production context. The six categories of SEI are: undercover space, grey zone space, satellite space, chameleon space, temporary space and accessing space. (Figure content J. Schaeffer and layout S. Andersson.)

The base for the analysis and the interpretation were the motifs from the manufacturing companies, that in the way they were described and experienced by the informants could be related to the characteristics of an explorative culture (see table 5). The spaces described by the informants included
qualities of the being-in interlacement with the spaces, from aspects of the use, of the bodily experiences, the thinking, the feeling and the habits. The analysis and interpretation showed qualities in the motifs related to explorative innovation culture were found as supporting a coexistence of an explorative innovation culture within the dominant exploitative innovation culture. The descriptions and experiences of the emergent explorative spaces for innovation are analysed and interpreted with help of theory and previous research and presented below as six categories of space: undercover space, grey zone space, satellite space, chameleon space, temporal space and accessing space (see also figure 22 and paper IV).

**Undercover space**

An undercover space is one that on the surface seems to fit in the dominant culture, but is a space where another culture is able to enter. The other culture plays by the rules of informal communication, openness – no forced change and has a loosely structured organisation.

The main example of undercover space in the empirical material was the coffee room. To take a coffee was functional and part of a basic need (drink) that could fit in the production thinking and culture. This is the cover. Under the cover, the coffee room was a place that marked a culture of values, artefacts and thinking that was different from the values, artefacts and thinking in production. To elaborate on Heidegger’s (1927/2010) terminology on the ‘tool’ and expand it to an interior, the coffee room was a tool in use. The users were familiar with the way the room could be used for relaxation, for reflecting on work or for having a chat, but also as a tool to navigate between the two cultures in the companies. For example, production was, in the description of informant 3.1, about rationality but the coffee area was a space that connected the rationality in the working sphere with the word ‘home’ and the private sphere and was a space open for discussions about other things than work. As he expressed it, it was a space for the soft side of life ”about feelings and experience … about our existence” (I 3.1). The undercover space is a space that shares qualities of dwelling, since it is a space that is described to open to a being with the space and each other as in a home. A space met with the attitude of ‘dwelling’ is important in an explorative innovation culture. Although Heidegger, to the author’s knowledge, never wrote about innovation, there are features in exploratory innovation research that advocate innovation as being something alive, coming from inside and dynamic, which are qualities in the ecology of openness as mentioned above (Peschl & Fundneider, 2012). Heidegger describes ‘dwelling’ with connections to the feeling of home, to growing, to take care, a relationship with both divinity and death in unity with the things (1927/2010 p. 54 and 1952/2008 p. 348f.). In the examples of the coffee rooms, there were no
references found to connections to divinity in the material, but references to growing, dynamic conversations, nurturing and taking care of things and to create trust between the people.

An undercover space like a coffee room might help an individual handle the coexistence of two different innovation cultures because it provides a different physical space with artefacts, thoughts and values that help a person to mediate between or separate two thought worlds and find an arena for the exploitative innovation culture within the culture of exploration. Here, a way to support the two thought worlds co-existence by developing different spaces for them is provided.

The coffee room seems to allow for ambidexterity on an individual level in a production unit, which is a difficult state to achieve because it demands on the individual level that one person inhabits two thought worlds (Dougherty, 1992). The physical objects create a barrier, which protects a moment in time, time for an informal conversation and makes it a dwelling space. The coffee breaks are a part of the company organisation, but not a part of an overt strategy for innovation. The breaks don’t work as a tactical differentiation on an organisational level to support explorative innovation (Adler et al, 1999). The coffee room shows an emerging spatial differentiation between two cultures and thought worlds.

There was no coherence in the choice of material or colour scheme in the motifs of coffee room described by informant 4.2, which was typical for all the photographs of coffee rooms. In the lean culture of the companies, it is important to reduce and not to create waste, which provides an incentive to use what you have. The furniture is not valued for communicating a certain style; it is chosen or found and placed for its function. There is, thus, a similarity in the thinking and use of resource efficiency and functionality between the relation to objects in production and in the coffee room, which can contribute to the relaxed feeling. It is possible that the furniture and the objects in the spaces cannot be too different from the ways of thinking about objects and workspace in production in order to provide the sense of security mentioned by informant 3.1 and the trust and feeling of openness described by informant 4.1. The coffee room here has a function-based design; the things in it are things that are used and chosen based primarily on their functionality (still the use and the choice is developed from was is valid in the culture). On the other hand, there are also differences from the production unit. In the production area, the 5S directs the placement of tools and machines and the use of colours should be standardised; the material revealed no indications that the 5S has influenced placement of furniture in the coffee rooms.

The coffee rooms were described as spaces supporting informal conversation, creating trust, give possibility for discussion and cooperation, similar to the findings in research on spaces supporting explorative innovation by Ekvall (1997), Allen and Henn (2007), McLaughlin, Bessant and Smart.
(2008), Nonaka, Toyama and Konno (2000) and Fayard and Weeks (2011). But, an important result presented within this dissertation, based on the analysed motifs from the manufacturing industrial companies, show that their function is doubled, in their undercover character. Another layer has to be added to their function when the coffee room are used within a dominant explorative culture. To share a coffee seems rational and works well in the culture of the industrial worker. It was scheduled in such a way that a worker, at least in the companies studied, had the right to at least two pauses in a workday. As a result, the employees were allowed or forced to leave the working floor or their desk. The undercover space was able to exist ‘in disguise’ by acting as not too much of a contrast, to the workshop.

Grey zone space

The grey zone space provides a certain balance between what is standardised, controlled and safe and what is improvised, uncontrolled and unsafe. The name grey zone is chosen to illustrate that the grey zone spaces hold a blend of contradictions within them. The example of the grey zone space in the material, the illegal meeting space, was created as temporal but remained for months. In the continuous improvement work, all objects and spaces are approved; this space was not approved (but placed there on the users initiative), nor was it removed, according to informant 1.6. The grey zone space can provide autonomy, with its ability to exist in a glitch in the system. The placement of the illegal meeting space supported rapid decision-making and actions with its proximity to the shop floor and relative distance from managers in the description of informant 1.6, and thus being an uncontrolled meeting space, that can support creativity in the explorative innovation culture (Ekvall, 1997). The grey zone space is supporting collective face-to-face interaction, much like the description of a dialoguing ba in Nonaka, Toyama and Konno (2000). What is especially characterising a grey zone space is that experienced as a space that plays with boundaries, both the experienced boundaries in the organisation and in the physical representation of ba. To create the right condition for ba, autonomy, as previous research puts forward, is one aspect that has to be provided since it supports commitment and motivates the search for new knowledge (March, 1996; Nonaka, Toyama & Konno, 2000). The grey zone spaces gives radical ideas room to develop and change direction, and users possibility to reflect, which is important to support explorative innovation as discussed by von Stamm (2008), and Peschl and Fundneider (2012). As a space described as working against the agreement of where meetings should be made and where furniture for those meeting should be placed, the grey zone space may provide a possible escape from the ‘they’ (Heidegger, 1927/2010).
Temporary space

A space that can easily be configured, moved to different locations and created in a few minutes is a temporary space. In the temporary space, the temporality is supported by a special attitude to the recorded and embedded form of information. The example from the material was the movable cart and the chairs in an improvement meeting. Informant 6.1 showed a way to create a frame to nurture an explorative innovative culture within the exploitative. In changing the conditions of use for a meeting space, reflection over the everyday routines in the use of a meeting space was made possible, and the workers themselves could create a meeting space. Temporality in placement and not clearly defined use of furniture hinder the temporary spaces to be easily integrated in the everyday routines in the way that they are not used in a standardised ordered manner, where the objects preferably has marked out placements (see Greif, 1991; Feld, 2001; Bicheno, 2004 and Liker, 2004). The temporary space deals directly with the everyday work, and the altering of everyday routines and use of spaces. The moving of the cart that the men used as coffee table shows, for example, that a temporary space is a space in which, the ‘they-self’ are less prominent, to use the notion from Heidegger (1927/2010). The fixed space – the opposite of the temporary space, for example, the meeting in the lunchroom described by informant 6.1, is here interpreted as a space where the constructing of a ‘they’ was coming forward in the way who was supposed to talk, and what was expected to say was regulated. The way informant 6.1, hindered a use of the conventional meeting space, directed the attention of the workgroup to focus on what a meeting room was. The conventional meeting room was completely hindered from being used and the mode to relate to it, changed. The whole space had become ‘obtrusive’ in its unready-to-handiness, which is one mode of the relation to a tool following the reasoning of Heidegger (1927/2010, p. 73f). The obstacle made the group go through a transition from a ready-to-hand relationship with the meeting place to a present-at-hand relationship with it. This opened up the possibility of creating new relationship with elsewhere, with the chairs, the table, the placement – and a new relationship with the idea that it is possible to rethink routines and actions in production. It shows that an action with a ‘tool’ that moves the focus from the ready-to-hand way to the present-of-hand in the way the ‘tool’ is experienced, was described to restore an authentic dialogue by I 1.6. The users, one may say, could see possibilities for innovation when they saw and used the space as a tool. The moving of furniture could be a contributing factor, making the people in the meeting come out from the everyday routines for a moment. The temporal space, is a category of space already introduced in previous research and are said to introduce a focus on discovery and experimentation (McLaughlin, Bessant & Smart, 2008), space to train to
build on others ideas and co-create prototypes (Leonard-Barton and Swap, 1999) which is then considered to support innovation. The temporary space, by its temporality, could be experienced to support a spontaneous, relaxed atmosphere (Ekvall, 1997).

**Accessing space**

Some spaces in the empirical material with potential to support an explorative innovation culture did not make it into the dominant exploitative innovation culture influenced by lean production and 5S. They were motifs described by the informants as spaces hindered innovation and were related to external input. Here, this category of space is named ‘Accessing space’. The examples of accessing spaces in the material were the entrance described as black and empty by informant 2.1, and the corridors described by informant 4.2 and 6.2. The accessing spaces bear a potential for reinforcing external communication, by welcoming, inviting and making connections with others that are beyond the close social network. The accessing space has the potential to be a space that supports the characteristics in explorative innovation that encourages using bridging ties and looking outside the close social network to search for new knowledge as described as important for innovation by (Raisch et al, 2009; Turner and Lee-Kelley; 2013, McLaughlin, Bessant & Smart, 2008 and Chesbrough, 2003).

An accessing space, is a space with potential to support the building of relations to people with whom it is possible to exchange new knowledge, and acknowledges that the design can support that. In line with the research of spaces providing a multi sensory experience of difference from everyday work (Oksanen & Ståhle, 2013 and von Krogh, Ichijo & Nonaka 2000), the accessing space has also a potential for creating an environment that provide an experience of a space that inspires to think outside the ordinary work tasks, a quality put forward by informants 4.2 and 6.2 and are inviting and welcoming as put forward by informant 3.3.

**Chameleon space**

The example of a chameleon space was the production at night. The chameleon space is used on the basis of its shifting character. The chameleon space is not primarily changed with help of the furniture, like the temporary space. It shifts character and can provide support for explorative innovation according to shifting contextual factors. For example, in the day when the production runs, it has the qualities expected for a space dominated by 5S, efficiency and stability. But with shifting contexts – for example, when day turns to night and the production is down, the space can be experienced differently.
and become a space for free thought, reflection, relaxation and new ideas, as described by informant 3.3. It emerges as a SEI, contributing with a difference to the routines of production in daytime.

A chameleon space is delicate because it has an ambiguous relation to ‘the they’ [das Man] (Heidegger, 1927/2010). At the same time as having permission from the management is one important factor for innovation (Fayard and Weeks, 2011) in the line of reasoning put forward here concerning the chameleon space, the permission may be destructive if it destroys the quality of integrity. The chameleon spaces are delicate because being incorporated in ‘the they’, the chameleon spaces become incorporated in something that we do as beings, in doing what is expected of us. Therefore those spaces have a kind of opaqueness – at least they hold a quality of not immediately be discovered and formed by the ‘they’ and how you usually are supposed to act.

The chameleon space gave opportunities to have time for reflection, there is an escape from what is expected in the everyday routines and everyday being with the spaces. The qualities experienced in a chameleon space can give openings to think and to act differently from the ‘they’, protected by the changed variables in the context. The protection provides then opportunities for a space for incubation and privacy as put forward as important for innovation by Leonard-Barton and Swap (1999) and Fayard and Weeks (2011) and creates an environment in which to listen to weak signals, to have time for reflection and questioning oneself and what you do (Peschl & Fundneider, 2012).

**Satellite space**

In the empirical material, the motif of cars by described by informant 3.3 and 4.2, is the example of a satellite space. The satellite space is a space outside the factory premises, which emerges as possible space for an explorative innovation culture because of a weak link to the factory premises, its culture and the everyday routines. The transport having a defined starting point and an endpoint made it possible to emerge as a SEI since a transport between two spaces defined can be considered as rational, and thus supporting emergence of less control during transport.

Satellite spaces hold in their physical enclosure opportunities for another culture that support incubation and privacy, but also with multimodal stimulation in visual impressions, speed, informal conversation, music and texture, in the experience of informant 3.3 and 4.2. Informal and unplanned communication creates opportunities for new ideas, creates trust and cooperation discussed by Dixon (1999), Allen and Henn (2007), and Fayard and Weeks (2011). The materiality, both as a mean of dislocation from everyday activities and an unusual sensory experience, is presented as one important aspect
of design of space for innovation, where, for example, smells and feeling of materials are considered to successfully support innovation (von Krogh, Ichijo and Nonaka, 2000). The satellite space in this example adds another aspect to this; it is the speed and acceleration – the experience of a space moving.

The six categories of space for explorative innovation, spatial differentiation and coexistence
The results of the analysis and the interpretation of the material, the six categories of space for explorative innovation, indicate that several strategies is involved in how the spaces are used. ‘Spatial differentiation’ is one example of how the spaces related to an exploratory innovation culture in the studied manufacturing companies may coexist with an exploitative innovation culture, from the perspective of the individual and provide a basis for ambidexterity. It relates to the tendency that the different spaces described are used by an individual or a group to separate a culture for explorative innovation from an exploitative innovation culture (and thus give opportunity for a possible coexistence between them). The six SEIs are categories of spaces that can give an opportunity for the explorative culture to emerge and grow. Here, the tendency of spatial differentiation is a way in practice of work to use the spaces as a tool to let the space be a help to differentiate the culture of exploitative innovation from a culture of explorative innovation. This complementary use may make it possible for one individual to cope with two thought worlds that are based on assumptions that are part of different cultures.
Support for ambidexterity

Based on the identification of the six categories of space for explorative innovation and the developed knowledge about each of these, some initial areas could be formulated in order to support the design process to create SEIs. Assuming that ambidexterity in innovation is related to artefacts for both an exploitative innovation culture and a culture of explorative innovation, it is of interest to understand how to stimulate the creation of spaces for ambidexterity that simultaneously house two cultures and how that process can be supported by design.

The results from the PEI study in the studied manufacturing industrial companies showed that the values coming forward in the descriptions of the recorded, embedded, expressed and experienced forms of information are in most cases related to a culture of exploitative innovation. The support and artefacts for a culture of exploitative innovation have been developed successfully with in companies implementing lean production, with help of various guides and descriptions, for example Liker (2004).

The spaces described in the context of the PEI study can be analysed as a tool for innovation activities. When the spaces for innovation in the PEI study were experienced and described as being used for something such as action, thinking and feeling around innovation, the tool is involved in the intangible aspects of innovation. Workspaces as tools have also similarities to a thing (in the experience of the spaces’ content and form) in being used as tool, and then the material, tangible side of the tool should not be ignored. To develop the manufacturing companies towards ambidexterity, one perspective is to understand how tangible forms of information, both recorded and embedded forms, can assist the individual and group that want to develop an explorative culture in an exploitative one.

The role of the designer and the product of design in relation to emergent spaces for explorative innovation has to be further elaborated in future studies and within design practice, since integrating a culture for explorative innovation within the exploitative is a challenge. It is a challenge to design

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9 A model to support radical improvements (an incitement for a exploratory innovation culture) was presented in paper II. In perspective, combining the result in paper III and the analysis made in paper IV, that suggestion may be defined as an “undercover space” in the approach and overarching idea. The spaces were presented in quite controlled phases that can be used in a linear and structural manner. The model seems to fit in the rational thinking in the exploitative innovation culture but in the spaces/in each phase, it may create a possibility to support an explorative culture. The model used the strategy of spatial differentiation to give a possibility for an explorative culture to emerge in a culture dominated by an exploitative innovation culture.
spaces for emerging explorative innovation as it is defined by Peschl and Fundneider (2008, 2012) just because of the emergent quality.

As a basic argument for the areas formulated as an initial support for design is therefore the importance to acknowledge the user experience and their understanding of their workspaces when designing for SEIs. Without a process where the understanding of the users’ understanding and experience of the context is involved, it may be hard to design for emergent actions or cultures, building on the reasoning of Krippendorff (2006). The spaces for innovation are, in this interpretation, less connected to the noun ‘space’ and more seen as the verb – ‘spacing’. In the spacing, the areas are related to each other as they give space to different and similar aspects of an explorative innovation culture. The spacing in the emerging SEIs make room for another culture than the exploitative, i.e. the explorative.

The six areas presented as an initial support for design is in line with the research on explorative innovation, to build on what is emerging, (i.e. the weak signals and practices of explorative innovation culture and its artefacts). Each area represents a communication space, which means that the areas can differ in which actions, objects and user understandings are important to create that kind of space (see figure 24). The areas described in the initial support for design are sometimes contradictory. The areas should be understood as a support for different communication spaces that could emerge in different locations for different users, for different functions and at different moments of the day. For example, the support to create accessing spaces, involves high visible and transparency, but to enable spaces that preserve integrity and provide privacy, like the chameleon space, requires another way of handling the visibility of the spaces. The areas are points of departure for a process, a suggestion to discuss, identify and enable emergent spaces for explorative innovation.

In formulating the six areas, there was an effort to find words that were not imposing, to use a language that does not contribute to control. The effort was to acknowledge the perspective of emergence, of how to take care of things that grow, words such as ‘identify’, ‘create’, ‘enable’, ‘nurture’, ‘protect’ and ‘acknowledge’. Practicing these words in a design process and in discussions how to develop the workspaces towards a support for ambidexterity in innovation, intending to create spaces for innovation may also demand a change in the mind-set of managers, to know when to support the exploitative culture and when to support the explorative one. The areas also include the users involvement in the design process.
Spaces for explorative innovation (SEIs) | The six areas in the initial support for design
---|---
Undercover space | 1. Identify, acknowledge and enable communication spaces for dwelling and openness.
Greyzone space | 2. Protect the spaces experienced as spaces in between.
Temporary space | 3. Nurture spaces that are experienced as temporal and easily modified.
Accessing space | 4. Create spaces that embrace clients’ and visitors’ existence and inputs.
Chameleon space | 5. Enable spaces that are experienced having integrity and that have the ability to change without immediate visibility to others.
Satellite space | 6. Allow spaces that create distance.

Figure 24. Visualisation of the areas (numbered from 1-6) in the initial support for design concerning spaces for explorative innovation and their connection to the interpreted results from Company 2,3,4 and 6. (Figure J. Schaeffer.)

1. Identify, acknowledge and enable communication spaces for dwelling and openness

To identify communication spaces that restore a form of dwelling is here understood as identifying spaces where the embedded, recorded, expressed forms of information are understood, used and experienced by the users as forming an attitude of safety and nurturing to the space. To acknowledge and enable communication spaces for dwelling, acknowledge in what way the experience of the recorded and the embedded form of information have to be designed to be experienced to introduce a sphere of “home” to the space, which differ in different contexts. For example, the furniture in a coffee room in the manufacturing companies is just slightly different from the ones used in production but can also be related to the sphere of home and then
becomes familiar to the user in two ways. To identify and enable communication spaces for openness is to identify the spaces where users grow their ideas in a non-demanding way and where informal conversation and play are supported. To acknowledge and enable the spaces for dwelling and openness could increase the preconditions for informal conversation and create trust, providing possibilities for reflection, discussion and cooperation.

2. Protect the spaces in-between
To protect communication spaces experienced as spaces in-between is a support for protecting spaces that emerge in a need for rapid independent decisions and actions. Such spaces, grey zone spaces, may emerge in non-permitted areas. In this form of support, it is necessary to find ways to protect embedded, recorded forms of information that are understood, used and experienced by the users as a space that supports risk taking in decision making and freedom from hierarchies. The placement underlines the in-betweenness of what is allowed and not allowed, which also protects and may allow a higher degree of the users autonomy in decision-making.

3. Nurture spaces that are temporal and easy to modify
To nurture communication spaces that are temporal and easy to modify is to provide a choice of embedded, recorded forms of information that are understood, used and experienced by the users as possible to rearrange and modify after the need in the moment. The nurturing consists of growing a special attitude to the space: “the artefacts are for us to use, to play with” or, for example, “the texts, images and sounds are ours to rearrange or order or we can create new ones”. The nurturing is not imposing, but is providing a frame within a culture where each artefact should have a place, a frame where it is clear that the placement is a choice for the user. In the manufacturing industrial context, to nurture spaces that are temporal and easy to modify, also means to provide spaces where waste and destruction are permitted, where no clear use is defined from the start and where changed meaning could be realised. These are spaces providing opportunities for ready-to-hand relationship to the things that are different to the ones in the exploitative innovation culture. The support for temporal spaces may increase the capacities for discovery and experimentation, to train to build on others ideas or co-create prototypes. By its temporality, it could be experienced to support a spontaneous, relaxed atmosphere. Find ways to make this SEIs become a location where a ready-to-hand relationship to the things is different in comparison to the one that are trained and established in the exploitative innovation culture.

4. Create spaces that embrace clients’ and visitors’ existence and inputs
This area includes an encouragement to identify all the zones of interaction between the company and the other world. For example, identify and create
spaces in the company that are understood and given meaning by the employees, visitors and costumers as spaces that provide access, welcome new inputs, and bridge ties in the relation between people outside the close social network. It involves to understand if the design of the entrance or website supports an experience for both internal users within the close social network of the company and external users with a weak link to the social network in the company that those connections are valuable for the organisation. These ‘accessing spaces’ that some of the visitors meet for the first time without a beforehand knowledge of them in use, need to be carefully designed with regard to transparency of use and visibility of content. This area may possibly increase the amount of and the quality in the relations that can create bridging ties and connections outside the close social network, which can bring new knowledge.

5. Enable spaces that have integrity
To enable communication spaces that have integrity means to enable spaces whose uses are not immediately transparent in the organisation. It is also to enable spaces where the embedded and recorded forms of information are understood, used and experienced by the users as forming a space for non-expected behaviour in the exploitative culture, that at the same time are permitted by management.

Therefore it is suggested that those supporting spaces have to be opaque – at least they should not immediately be discovered and formed by how you usually are supposed to act. The space gives opportunities to have time for reflection, when there is an escape from what is expected in the everyday routines and in the dominant culture. This area may contribute to a change in the culture and bring out more radical ideas and ways to implement them, since to enable spaces that have integrity can give openings to think and to act differently from the ‘they’, protected by the changed variables in the context. For this spatial support, it is important from management perspective to give permission to create opportunities to use places at different times of the day, to be open to new uses of existing spaces. Give the user the ability, without making this too transparent in the workspace, to use it be able to change the context of the spaces in order to escape from what is expected in the dominate culture of the company.

6. Allow spaces that create distance
To allow communication spaces that create distance is to find or design and to give a permission to use different enclosures where the embedded, recorded forms of information are understood, used and experienced by the users as different from the everyday routines and give a sense of freedom. The moving space is still related to a fixed space before and a fixed space after. Allowing what can be categorised as ‘satellite spaces’, may enhance the possibilities for incubation and informal conversations. One quality they
have is the weakened connection to the routines of the everyday. At the same time as they are experienced to create a distance from everyday work, they are also integrated in a meaningful way in the everyday doing.
VI. Discussion

The results in this dissertation concern workspaces that users, managers, operators and designers found being important to innovation. This perspective complements previous research on spaces for innovation on a micro level presented by Nonaka and Konno (1998), Leonard-Barton and Swap (1999), Nonaka, Toyama and Konno (2000), von Krogh, Ichijo and Nonaka (2000), Haner (2005), Lewis and Moultrie (2005), Allen and Henn (2007), Moultrie et al (2007), Fayard and Weeks (2011), Peschl and Fundneider (2012) and Oksanen and Stålhe (2013). It does so, in its focus on investigating the user’s experience and descriptions of workspaces for innovation. The phenomenological perspective contributes to elaborate how everyday workspace can make room for innovation, in the way it is experienced and meaningful in relation to innovation for a user.

In discussing whether the results have developed knowledge and understanding of workspaces for innovation as a phenomenon from a user’s perspective, it firstly has to be noted that the basis of the empirical material is limited to five companies, with four of them in a Swedish context. Secondly, since the material was condensed from 300 photographs and the interviews with 31 informants, which resulted in more than 40 hours of recorded material, what has been presented has been filtered by the author. The base for the initial support for design was limited, and moreover, there is a possibility that the generalisation from the particular experience to the characteristic of the SEIs weakens the validity of the interpretation by being too separated from the particular experience. At the same time, the research questions, the use of categories from previous research on innovation and the structuring of the analysis with the help of the photographs and the interviews were attempts to enlarge the perspective and to find relevant structures and contents. Thirdly, the empirical material and theoretical perspectives had the potential to be given greater depth. Keeping these limitations of the results in mind, another item for discussion regarding if the results have developed knowledge and understanding of workspaces for innovation as a phenomenon from a user’s perspective has to concern the results presented in relation to the meeting between everyday, innovation and workspace.
Workspace design for innovation

One point of discussion based on the results, is if it is possible to create SEIs within manufacturing production units. The everyday routines are made explicit with help of 5S and other methods within lean production. The results indicate that the rational thinking, the transparency, the follow up and the control that come with an exploitative innovation culture can create a modern factory that de-places the spaces for explorative innovation culture to the margins of the production unit based on where the SEIs in the empirical material were placed (see table 5). This is indicated in the results by the few motifs of coexisting spaces for emergent innovation in the manufacturing companies and where they were placed in relation to production. The results suggest that a culture of explorative innovation is not strategically prioritised in production and in associated functions studied, even though some motifs show an emergence of an explorative culture. Explorative innovation can be supported in some other department, for example, the product development department, which is one way to handle ambidexterity on organisational level (Raisch et al, 2009). The results present experienced spaces for innovation within the manufacturing production units and one part of the results presented concern another possible way to handle ambidexterity in how the relations between users, workspaces and different innovation cultures take form.

An explorative innovation culture brings a belief in actions and thinking that is beyond the routine, in a way, beyond a culture for exploitation, and some spaces for explorative innovation coming forward in the results seem to demand another attitude to workspace than spaces for exploitative innovation. It is within this discussion – a discussion about the degree of the inclusion of spaces for different kinds of innovation in the everyday workspace and the attitude to them – the notion of ‘everydayness’ and the phenomenological perspective can contribute.

Everydayness dominates our existence, according to Heidegger, and it is only possible to escape for a moment (1927/2010 p. 371). One perspective in the everydayness is the everyday routines, which are created when one does what is expected. This reasoning becomes interesting when discussing the result on spaces for exploitative and explorative innovation integrated or in relation to the everyday routines, and the attitude of indifference that everydayness brings to the being-in a workspace.

On one hand, the majority of the motives in the material for the PEI study shows spaces for exploitative innovation, which is supported by explicit and implicit directives (for example the implementation of 5S) in the routines concerning production. The spaces supporting exploitative innovation are described with an attitude that the most supportive ones are the ones that best follow the routines, and that the routines are not questioned and almost automated.
On the other hand, the user experiences of some SEIs are described with qualities of contrast both from the everyday routines and everyday spaces as a support for innovation, a quality of contrast, which brings with it a non-indifferent attitude to the workspaces. The SEIs as the satellite space, temporary space and chameleon space are placed in or have strong relations to the everyday workspace and everyday routines, but the descriptions show that a quality in them supporting explorative innovation is a dissimilarity to everyday routines. This description of the quality of contrast to the everyday routines and experienced everyday spaces are in accordance with previous research, where a design of a building show attempt to bring attention to the materiality, to present the objects in another way – with for example help of smells that changed from the everyday experience and routines in a workspace to support innovation (von Krogh, Ichijo & Nonaka, 2000). Lewis and Moultrie (2005) put forward the importance of separation from the everyday routines and spaces when discussing the innovation lab. Another relation between everyday routines and the SEIs, is shown by the undercover space in the material, exemplified by foremost the coffee rooms. The undercover space exists within the routines, protected by the routines, a key for their function and a possibility to create an attitude and an experience of dwelling.

The grey zone space exist used with an attitude of rebellion of the everyday routinely placement of objects on the shop floor. The accessing space becomes a hinder for innovation in the attitude of indifference in the everyday routinely use of it. In the results presented here, the spaces are situated within or with a strong relation to the everyday workspace and with different attitudes to everyday routines. The spatial differentiation is important, not as a strategic direction but as a tactic to create space for the explorative culture with different relations to the everyday routines in an exploitative innovation culture. The result nuances the view on the contrast from everyday concerning spaces for innovation in von Krogh, Ichijo and Nonaka (2000) and in Lewis and Moultrie (2005).

The rational modern factory, if represented by the users’ experience and descriptions of workspaces in Company 2, 3, 4 and 6, is almost without experienced SEIs. One reason to formulate the six areas to support the design of SEIs is that if a company working in lean context wants to enlarge their capability for ambidexterity concerning innovation, they should provide opportunities to create and use spaces supporting both explorative and exploitative innovation cultures. But one threat to the SEIs is to make them strategically important and include them into routines supported by ‘guidelines’. In fact, an important comment and a critical point of discussion to the initial support for design presented above is the risk to implement it interpreted as pure guidelines. Within a culture dominated by exploitative innovation, giving attention to the spaces supporting an explorative innovation culture may destroy the conditions that make some of them functional. As presented,
some of the SEIs emerging within an exploitative innovation culture seem to be dependent on non-transparency and on a possibility to be unnoticed.

Still, the areas formulated as an initial support for design are intended to be adapted by designers, managers and users to be used as an input to a design process for future or existing workspaces to support an explorative innovation culture into an exploitative one. It has to be noted that the explorative side of the ambidextrous company and the spaces supporting exploration can unbalance power relations in the production area, since the explorative emergent innovation brings with it a period of uncertainty and profound change, and not immediate success as discussed by Peschl and Fundneider (2008). Succeeding in creating a highly nurturing explorative climate to generate profoundly new knowledge is a support to radical innovations (ibid.). Supporting an emerging explorative innovation culture with help of the workspaces, may lead to more risk taking, a greater chance of chaos (the opposite of the underlying goals in the exploitative innovation culture lean production supports). Based on this reasoning, it has to be taken in consideration that the SEIs are spaces that demand thoughtful concern before starting a process to create them or support their spontaneous emergence. In the current version, it can contribute to a discussion of what is possible or desirable when it comes to design spaces for innovation in a manufacturing context, as Fallmann (2008) put forward as different roles of design. Designers or companies trying to explore and design their workspaces to facilitate innovation may use the points in the support for design of SEIs as a basis for a discussion about power, innovation, use and design of workspaces. The support should be tested and further developed as a contribution into a design process for SEIs in the manufacturing industry.

Space as a ‘tool’ for innovation

Another perspective of how the dissertation develops knowledge and an understanding of workspaces for innovation compared to previous research on spaces for innovation presented by Nonaka and Konno (1998), Leonard-Barton and Swap (1999), Nonaka, Toyama and Konno (2000), von Krogh, Ichijo and Nonaka (2000), Haner (2005), Lewis and Moultrie (2005), Allen and Henn (2007), Moultrie et al (2007), Fayard and Weeks (2011), Peschl and Fundneider (2012) and Oksanen and Stålhe (2013) is the introduction and development of understanding spaces for innovation as tools. When the spaces are experienced and related to what can be defined as supporting or hindering explorative innovation by the user, the spaces for innovation are interpreted as tools in work and included in the everydayness. Spaces for innovation as tools are here discussed from four different perspectives.

Firstly, the notion of ‘tool’ with its conjoined notions of ‘ready-to-hand’ and ‘unready-to-hand’ contribute to explain how, within the everydayness,
the function of the space as a tool supports coexistence between the two modes of innovation. In the discussion about spaces for innovation as a tool, there is a possibility to introduce a function, within the everydayness, but outside the everyday routines – to reflect on and intentionally redesign the material side of the workspace. If a space, for example a temporary space or a satellite space, by its unfamiliarity from the everyday routines, breaks the ready-to-hand-relation to the workspace and becomes unready-to-hand, the unfamiliarity brings the attention back to the materiality of the tool. In the unready-to-handness, the spaces and the objects function both as a metaphoric question of “how and what should we use this for?” in order to question habits and as an influence on experience as a ‘tool’ for innovation, being a tool for the external inputs.

Secondly, when space for innovation is experienced as a tool, the material and the form are not separated from the use. Their form and their content are interlaced in them when used as material tools for innovation, and their form and their content are understood from the use. The interiors and the artefacts within them, which both relate to exploitative and explorative understanding of innovation, are presented in the material as strongly related to the experience of the materiality in use. The emergent explorative innovation, as defined by Peschl and Fundneider (2008) and the spaces related to them, push the being of spaces for innovation as a ‘tool’ in a special direction since they are emerging tools, and as such also involve in the immaterial part of the explorative innovation process. The answers about the exceptions in the material from the manufacturing industry, the coffee rooms, car and so on, give answers as spaces for innovation being understood in relation to existential questions, joy, time to reflect over the everyday routines. In that, the space as a tool for innovation also has to include ways to be experienced and meaningful as a space that creates an opening, an opening for something that is never the same again, to follow the definition of emerging explorative innovation by Peschl and Fundneider (2008). At least, space as a tool for emergent innovation provides a possibility of that happening.

Thirdly, the difficulties of creating innovation laboratories could be discussed to exemplify how spaces for innovation could benefit from being discussed as ‘tool’ in Heidegger’s definition of the word. Earlier research found that there was a need for facilitation to make innovation labs function, that creating one involves a considerable investment for something with a relatively short life span and that an innovation lab has to be incorporated in a company’s innovation strategy to be more sustainable (Haner, 2005; Lewis and Moultrie, 2005; Moultrie et al., 2007). An additional perspective presented here, on the difficulties with the creation of innovation labs is that space for innovation is not sufficiently understood on an ontological level. With the definition of Heidegger’s (1935-36/2005) ‘tool’ in mind, the spaces of innovation as a tool should be made meaningful by the user. What can be forgotten in the process of design spaces for innovation, following
Heidegger’s definition of ‘tool’ is that in being a tool, the tool firstly is understood based in the experience of it in its use. In innovation laboratories, users may not be familiar with what a space for innovation is because of a lack of a previous and ready-to-hand relation to the space in use. Spaces for innovation in practice is then understood more toward a ‘thing’, a thing disconnected from use. For example, a space just showing “we work with innovation” (i.e. branded space for innovation) are in their being given as a thing with the form and content being disconnected from the usefulness of the space.

Lastly, in designing spaces for innovation, the discussion of how spaces for innovation can be understood as a tool is of relevance. This discussion contributes to the research with three perspectives on design: First, in the design processes for SEIs, there is a possibility of building on emergent spaces that users already know in a ready-to-hand relation with them as tools understood and experienced as supporting or hindering explorative innovation. Those spaces experienced and described as supporting explorative innovation, already proved their probability to support an explorative innovation culture. Second, when being clear about the space for innovation as a tool, the direction of facilitation can have a stronger focus to also train the user to handle the tool, i.e. the space independently and not just to train the processes taking place within the space. Thinking of space as a tool is an impulse to train the people using the spaces so they understand and learn the way this tool is when it is used. This moves the designers’ role from designing the interior to being a part of the innovation and organisational processes. Third, an implication for design is that the design of the spaces should afford (i.e. by its design give an indication of) the use of the SEIs. In this process, it is important to base the design in how the spaces are understood by the users in their ready to hand relation to SEIs and at the same time enhance and develop these qualities with the spatial design.
VII. Conclusion and Future Research

This dissertation highlights the experience of workspaces in four manufacturing industrial companies and one design and innovation consultancy. The result shows individual attitudes as well as the influence of the company culture on workspaces and innovation. The results show that there is a relationship between company culture, an individual's experience and understanding of which workspaces are considered to support or hinder innovation and why they do so. From the material, it can be concluded that the manufacturing production units studied form a culture that produces few spaces that are made meaningful for users in relation to explorative innovation. Such places were made meaningful in the design and innovation consultancy. Clean and orderly spaces were put forward in the material from the manufacturing industry showing a dominant exploitative innovation culture, and the informal, collaborative and visually simulative from the design and innovation design consultancy, showing a dominant explorative innovation culture.

The results show that in a culture of exploitative innovation in Company 2,3,4 and 6, there were still spaces that emerged and enabled a possible co-existence with a culture for explorative innovation. The results indicate that some users tend to practice what here is called spatial differentiation to be able to hold two contradictory cultures in a workspace where one culture is dominant. Six categories of spaces were found in the descriptions of the workspaces showing a possibility for spatial differentiation that support ambidexterity on the individual level. They were interpreted as undercover space, grey zone space, satellite space, chameleon space, temporary space and accessing space in the manufacturing production context. This result has implications for design practice and has to be followed up with future research. One implication for design practice, research and industrial management is the challenge to redefine the notion of the ‘innovation lab’ and to take into consideration emergent SEIs in all parts of the organisation in a design process.

One support for workspace design is the six areas presented to strengthen emerging SEIs in manufacturing companies dominated by a culture of exploitative innovation. Since the basis for the initial support for design in the empirical PEI study is considerably limited, and every context has its own variation, the initial prescriptive study has to be evaluated in manufacturing and in other contexts.
The results of this dissertation add to the theory within the area of design research and one area of contribution is to the field of Human Centred Information Design research (see figure 25). The relevance of this dissertation for HCID research is the theoretical elaboration of the role of the user, artefact and design in relation to innovation. The result contributes to both design practice and education since it can open a discussion about the role of design, the designer and what design is, especially when researching and designing spaces with emergent qualities within an exploitative innovation culture. That issue moves an information designer from the materiality of the workspace design to focus on the processes, user experience and understanding of the workspace, when involved in a design process for SEIs.

![Figure 25: Areas of relevance and contribution.](image)

The new knowledge also adds to the area of innovation management research concerning the results presented on the spaces for innovation on a micro level from a user perspective and the acknowledgement of spatial strategies for ambidexterity in an organisation. Compared to previous research in innovation management related to workspace (Moultrie et al, 2007) where an assessment framework presented targeted the spaces that were strategically pointed out as important for innovation, this dissertation presents results on emergent spaces for innovation.

The results provide a basis for discussion about the workspaces in the manufacturing industry, the role of the culture and how the workspaces can be formed to support innovation and ambidexterity. The meaning that the users put into the relation between their workspaces and innovation can contribute to a discussion of the direction and content of an innovation strategy. The industrial contribution is the new knowledge that can contribute to an
awareness of the potential of the workspaces role to support innovation for managers and other decision makers in manufacturing industry. It is a contribution with new knowledge that is both valuable in early phases in design projects and in production operations, especially in the lean production context where incremental and radical innovation are fundamental.

The future research area that has been opened up from the results is that of workspace design supporting emergent explorative innovation. One possible extension of this design research is to apply, test and evaluate the initial prescriptive study in various contexts. For further research, the role of artefacts from a user perspective as a tool for innovation in relation to integrity, transparency, attention, communication is a possible trajectory to follow, relevant for the research in innovation and design.
Reference List


Allen, T.J. (1977). Managing the flow of technology: technology transfer and the dissemination of technological information within the R&D organization. Cambridge, Mass.: MIT.


### Table 6. Observations, interviews, feedback and co-design projects

<table>
<thead>
<tr>
<th>Company</th>
<th>WHO</th>
<th>WHEN</th>
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<th>DURATION</th>
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<td>PEI</td>
<td>13h</td>
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<td>I 1.1 – I 1.8 Employees passing by</td>
<td>2011-10-27 - 2011-10-28</td>
<td>Observation</td>
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<td>2013-02-06 - 2013-02-08</td>
<td>Interview</td>
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<td>2011-11-15 - 2011-11-18</td>
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