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Tool complexes of innovation: Spaces for explorative innovation in four manufacturing industrial companies

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Abstract

Providing an environment in which both radical innovation and continuous improvement can exist, i.e. an ambidextrous environment, is one of the biggest challenges management faces. While having an ambidextrous organisation is of central importance to the competitive advantage of a firm, there is limited understanding of how to manage it.

In this article, we are reporting on our research on the design of workspaces and the relations between design and ambidexterity in innovation. We studied the workspaces as artefacts in innovation cultures. We analysed relations between users and spaces that could enable an explorative innovation culture to emerge, and found spaces related to explorative innovation that coexisted with an exploitative innovation culture in production in the manufacturing industry.

The results indicate that to develop ambidexterity on an individual level in a culture dominated by exploitative innovation, one strategy is spatial differentiation. The result shows that artefacts relating to a culture for explorative innovation in the studied manufacturing companies are artefacts in a marginalised culture. We present six spatial characteristics for artefacts in the marginalised culture: undercover spaces, grey zone spaces, satellite spaces, chameleon spaces, temporal spaces and accession spaces.

Keywords
Workplace design; explorative innovation; ambidexterity; design research; manufacturing industry

Providing an environment in which both radical innovation and continuous improvement can exist (an ambidextrous organisation) is one of the biggest challenges management faces (Harrington, 1995). Although ambidextrous organisation is of central importance to the competitive advantage of a firm, there is limited understanding of how to manage it. A gap exists in micro-level research on the underlying mechanisms, architecture, and dynamics by which organisations can have an environment of exploration and exploitation, on both individual and social levels (Turner, Swart & Mayor, 2013). In an overview of space, organisation, and management thinking Chanlat (2006) finds space a key issue for organisation. However, despite its importance, it has only recently become a central issue in management thinking (ibid.), and the relation between users, the workplace design, and innovation in manufacturing production facilities are underexplored. In researching spaces for innovation in manufacturing companies, we found a possible relationship between workspace and ambidexterity. In this article, we will report on the dynamics between the explorative and exploitative characteristics of innovation, on a micro-level, focusing on users and workspaces in production in manufacturing industry.

Already published results from this study (Schaeffer and Eriksson, 2014, in press), have shown that a vast majority of the motifs of spaces that employees perceive as hindering and supporting innovation show good implementation of 5S. 5S is one tool, often used to
achieve a lean production, which introduces rules in the production units, gives structures and establishes routines over the placement of material, objects, and people. 5S mean in English sort, set in order, systematic cleaning (shine), standardize and sustain (Hirano, 1996). In short, when asking about spaces for innovation, we received answers about spaces and objects for continuous improvement work, favouring routine, good standards, waste reduction, and accessibility. Spaces that support exploitative innovation were the dominating pattern in the results. One may say that the above-mentioned aspects of the findings were expected in an environment directed against lean production.

Here, we will present motifs from the results that diverge from the main motifs. They were not analysed in Schaeffer and Eriksson (2014). We found motifs with traces of an explorative innovation culture that show a coexistence with spaces and objects for continuous improvement.

Accordingly, we are developing research on the design of workplaces and its relation to ambidexterity in innovation. We are, more specifically, directing our work towards answering the question: What are the spaces that can enable an explorative innovation culture to emerge and coexist with an exploitative culture in production in manufacturing industry? How do employees reason about experiences, values and norms in their work practices in relation to workplaces supporting explorative innovation?

The result from this study can inform and be developed by decision makers, designers, design researchers, architects, and users when they are about to plan a production unit and want to use spatial design to support an ambidextrous innovation capability.

**Theoretical framework**

*Workspace as an artefact in a culture*

The design of workplaces is the surrounding culture organised, formed with consideration to conventional and cultural traditions inherent in the enterprise or organisation. Schein’s (1984) definition of organisational culture describes different levels of visibility of culture. The most visible level of culture, according to his theory, is the artefact, which includes written language, the physical space and layout of organisation, and the overt behaviour of individuals. Less visible are values, which represent the unspoken rules the members are expected to understand by themselves and are thus a sort of standard for expected behaviour. The unspoken rules are often indirectly visible in the way, for example, a space is organised. The third and least visible level of culture is the underlying assumptions, which are beliefs and habits of perception, thought, and feeling that are taken for granted. According to Schein (1984), the organisational artefacts and values can reveal information about the underlying assumptions.

Schein’s theory was useful for our research because we are exploring the relationship between physical space and aspects of cultures for innovation such as values, rules, thoughts, thinking, actions, and feelings. Schein’s definition of organisational culture suggests it is natural for a culture for exploration to create different artefacts than a culture for exploitation creates. When studying the artefacts, we can learn about the dynamics between exploration and exploitation culture.

Additionally, in this study the perspective of physical space and artefacts in the spaces are seen as tools in use in every day work life and processes. Heidegger (1927/2010) regards the use of the tool as the basis for our understanding of them. The tools are involved in a meaningful context, and are given to us in different modalities of being, which can be described by Heidegger’s concepts of ‘presence-at-hand’ and ‘ready-to-hand’ (1927/2010 p.70ff). In working we use tools, for example, without reflecting about them and, according to Heidegger, we do not even see them when they are in ready-to-hand (1927/2010 p. 73f). The unseen relationship has to be shaken to become visible. In Heidegger’s thinking...
about things, an interruption can make a whole life world become visible, ‘become present-at-hand’ (Polt, 1999). According to Heidegger (1927/2010), in the practice of work, things are understood in a tool-complex within a space where the things can refer to one another and the multimodal lived experience.

**Ambidexterity in innovation**

In previous research, innovation is often classified as *exploratory or exploitative*. Exploratory innovation has a character of radical change and great risk and exploitative innovation has a character of incremental refinement of existing products with minimal risk taking (Jansen, Van den Bosch & Volberda, 2006). Exploration and exploitation have implications for culture, structures, capabilities, processes, and strategies since they demand significantly different things from these aspects of organisation (He & Wong, 2004).

The characteristics of a culture for explorative innovation 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 (He & Wong 2004; March, 1996; Peschl & Fundneider 2012; Turner et al., 2013). In the exploratory innovation mode, innovating and creating new knowledge cannot be managed in a mechanical manner. Peschl and Fundneider (2012) suggest developing an enabling context in which the processes of creating new knowledge and innovation can emerge and the physical space and the mindset are part of the context.

Exploitation, on the other hand, has the characteristics of mechanical structures, refinement, efficacy, selection, implementation, execution, mechanistic structures, tightly coupled structures, path dependence, routine, control, bureaucracy, and rules (March, 1996; He & Wong, 2004; Turner et al., 2013)

It is challenging to incorporate an explorative-enabling context of cultivation, facilitation, incubation, and enabling in a context dominated by a controlling culture. According to Raisch, Birkinshaw, and Probst (2009), the companies that find ways to do it, the ambidextrous companies, are the most successful. A coexistence of both incremental and radical innovation cultures will ‘encourage growth of an “ambidextrous innovation” capability’ (McLaughlin et al. 2008 p. 319). We will present tension pairs presented by Raisch et al. (2009) how ambidexterity can be developed. The first pair is *differentiation* and *integration*. A company has a strategy of either separating exploitative and explorative activities or integrating them. Moreover, the integration of ambidexterity can take place on an *individual or organisational* level. Some studies indicate that on the individual level, ambidexterity is rooted in the individuals’ ability to explore and exploit (Raisch et al. 2009).

At the same time, the individual dimension of ambidexterity is difficult because it demands that a person inhabit two ‘thought worlds’. Innovations require insights from a variety of specialities, in other words, different thought worlds (Fleck, 1979; Dougherty, 1992). In a company, different departmental thought worlds with different bases of knowledge face obstacles to easily sharing ideas. A central idea or action presented by one person can be viewed as meaningless by an employee in another department or another thought world (Fleck, 1979, Dougherty, 1992). Adler et al. (1999) discuss how production workers and the whole organisation at a plant combined, on an individual and organisational level, continuous improvement work with parallel organisational structures, for example, quality circles and pilot teams. These parallel organisational structures are called ‘tactical’ differentiation by Raisch et al. (2009).

What is interesting in Adler et al. (1999) from the spatial perspective is that in a description of this tactical differentiation there was an implicit kind of spatial differentiation. One informant mentions an artefact as sign of being part of a new group. ‘I’m on the Pilot team now. I’ve got a desk’ (Adler et al, 1999 p.56). The spatial implications of tactical differentiation are not developed further in Adler et al (1999).
The tension pair of *internal and external perspective* is important; social networks are important where strong ties are needed to integrate knowledge, and bridging ties is needed to access diverse and new knowledge (Raisch et al., 2009).

To analyse the material, we created categories based on previous research on explorative innovation, to find which places related to characteristics of explorative innovation in a lean environment and in the informants' thinking around the places (see Table 2).

Table 2: Dimensions defined in order to find occurrences of motifs in the material with connection to an explorative innovation culture

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Openness</td>
<td>Peschl &amp; Fundneider (2012); Ekvall, (1997); Mc Laughlin et al., (2008)</td>
</tr>
<tr>
<td>External input and Weak ties</td>
<td>Turner &amp; Lee-Kelley (2013); McLaughlin et al. (2008); Chesbrough, (2003)</td>
</tr>
<tr>
<td>Informal communication</td>
<td>Fayard &amp; Weeks, (2011); Dixon, (1999); Allen &amp; Henn, (2007); Ekvall (1997)</td>
</tr>
<tr>
<td>Permission</td>
<td>Peschl &amp; Fundneider, (2012); Fayard &amp; Weeks, (2011); Ekvall, (1997)</td>
</tr>
</tbody>
</table>

Method

The study of the relation between values, experience and artefacts in manufacturing industry calls for a method that makes understanding the values and experience of spaces and objects in use come forward. Methods from ethnography are increasingly used in design research (Rose, 2012). Design ethnography has been used in participatory design projects to provide understanding of user values and experiences (Ylirisku & Buur 2007). It has also been used to understand ‘the particulars of daily life in such a way [...] to reduce the probability of failure specifically due to a lack of understanding of the basic behaviours and frameworks of consumers’ (Salvador & Andersson, 1999 pp. 35-41). We used an interview method, the photo-elicited interview, which puts the focus on the lived experience of the workspaces and the everyday experience of work in relation to innovation. Photo-elicitation was originally an ethnographic method (Ball & Smith, 1992). In line with ethnographical research tradition, we chose to take into consideration all motifs photographed. It means that even if a motif is rare, the phenomenon exists as a part of the culture (Wolcott, 2008). The study was done at four manufacturing companies (Table 1).

Table 1. Companies, sectors, informants in the study

<table>
<thead>
<tr>
<th></th>
<th>Business sector</th>
<th>Number of employees in local unit (worldwide)</th>
<th>Informants in the study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company 2*</td>
<td>Steel refinement</td>
<td>45 (0)</td>
<td>11</td>
</tr>
<tr>
<td>Company 3</td>
<td>Steel refinement</td>
<td>70 (0)</td>
<td>4</td>
</tr>
<tr>
<td>Company 4</td>
<td>Fluid handling</td>
<td>210 (16 050)</td>
<td>4</td>
</tr>
<tr>
<td>Company 6**</td>
<td>Truck parts</td>
<td>850 (110 000)</td>
<td>5</td>
</tr>
</tbody>
</table>

*Company 1, a design and innovation consultancy are omitted here since that business sector is out of scope for the article.

**Company 5, was part of a pre-study developing the use of method.

Photo self-elicitation interviews were done with 24 employees between 2011 and 2013. We wanted both the managerial and the shop floor workers perspective on spaces and innovation, so 8 informants on the managerial level (two in each company) and 16 on the operator level in production were chosen for the study. Companies 2 and 3 were chosen because they had started an implementation of lean production and were interested in
both radical innovation and continuous improvement. They were also examples of small companies delivering parts and providing service to other companies. Companies 4 and 6 were chosen because they have standardised ways of working, with continuous improvement being the way to improve production, and the units studied are parts of a multinational concern.

Each photograph had several possible readings, therefore, we introduced the use of a written follow up and an interview that invited the informants to describe what they had depicted on the photograph and why. The things found in the photographs were ‘conditioned to the cultural knowledge the viewer brings to the viewing’ (Ball & Smith, 1992, p.18). An analysis of visual material is not stronger than the strengths in the categories because the categories themselves contain the substance of what was investigated (Ball & Smith, 1992). Since we choose to create categories from previous research, the categories are wider and deeper than the motifs we found in our material, and that we chose motifs that had at least one category in them.

**Result**

In the empirical material, 215 photographs, 1075 keywords, and 24 interviews, twelve motifs were found that could be connected to characteristics of a culture of explorative innovation. The motifs were coffee rooms, an aquarium, an illegal meeting place, a lounge area, a chat beside a machine, a telephone, cars, an office unit in an office and two meeting spaces in production, an invitation to a Christmas party and an empty reception area, boring conference rooms and a corridor. We will present findings around the motifs of coffee room, cars, the illegal meeting place, empty reception and a corridor.

**Table 5: Motifs with characteristics for explorative innovation**

<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 example (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 (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>Corridors and boring conference room (10)</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Motifs with characteristics of an ecology of openness

The coffee room, invitation to a Christmas party, aquarium and conversations beside machines were motifs with characteristics of openness. The coffee room, will be used to exemplify those motifs, occurred in empirical data from workers on the floor and managers alike. It seems that during the coffee break, the coffee room has at least four characteristics of explorative innovation: ecology of openness, no forced change, informal communication and loosely structured organisation.

The coffee room belongs to the workspace but offers openness, spontaneous, and possibilities to talk about work or other subjects. It is a 'common meeting place for all different functions and roles' (Interview with informant 6.1, working at managerial level in production in Company 6). Informant 6.1 photographed both the coffee room at shop floor and examples of combining an improvised temporal coffee room with an improvement meeting. A reoccurring characteristic in the description of the coffee spaces was spontaneity, a spontaneity that concerns when to go there, what to talk about, and the possibility of finding the right people. It is spontaneous in contrast to the fixed times for improvement meetings or activities when working with the continuous improvement work and production.

Informant 4.2, who 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 (see fig. 1).

Figure 1: The motif of a coffee area. Photograph by I 4.2.

On the wall, (here masked with white squares) three maps showed the area outside the factory and some diagrams and printouts of sketches of parts in the production. There is little coherence in the choice of material or colours scheme in the area and the office surrounding it. Those who use this area are 13 production technicians and Informant 4.2 (their boss). The operators drink their coffee on the shop floor.

Informant 4.2 said it is interesting to sit down and listen to the discussions, and that he learns a lot about what is going on. He said that it can sometimes be a ‘hell of interesting discussions’ and that he gets away, away from his screen and his computer. He sits down and it is relaxing, and someone present an idea and then the discussion gets rolling. He described this part of the office, when used for breaks, as a giant forum for ideas.

J: What is it that makes the spaces comfortable, as you wrote here?

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 chose not to open up. But in this circumstance there is a greater tolerance and greater feeling of security.

In Company 3, a shop floor worker, informant 3.1, also choose to take a photograph of a coffee room.

He talked about innovation as problem solving, frictionless flow, optimisation and to do things right away. He was expressing a rational view of working life in production, a working life disconnected from the parts of life that include feelings, thinking and actions that do not immediately pay off economically.

When talking about the photographs, it seems that in this rational thinking, there were still connections to another thought world, what he called ‘the soft side, about feelings and experience … about our existence’. He portrayed the coffee room as the source of reflection and thinking – and he said that the reasoning could support innovations. He mentioned relaxation, caffeine, reasoning, team spirit, and safety. Twelve employees were using this space to have a coffee on the shop floor. In the interview, Informant 3.1 said this space gives a ‘home’ feeling because it acts like a home base for the team and that provides a feeling of safety.

Our interpretation is that the coffee room is a space that marks a culture of values, artefacts and thinking that is different from the values, artefacts and thinking in production. To use Heidegger’s terminology, the coffee room is in the informants’ experience in use, a tool for relaxing and reflecting on the work itself or for having a chat. By participating in the study, the informants started to reflect over the coffee area and the place and objects became present-at-hand, and the experiences and associations around the spaces started to come forward.

Production was in the mind of informant 3.1 about rationality. The coffee area is a space that connects the rationality in the working sphere with the word ‘home’ and reminiscences of another sphere, the private sphere. The coffee room, at the shop floor, is called the ‘home’ base. Here is the safety and relaxation that can produce new ideas, according to informant 3.1. 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 that one person inhabit two thought worlds (Dougherty, 1992). A space like a coffee room might help an individual handle ambidexterity because it provides a different physical space with artefacts, thoughts and values that help a person to switch between or separate two thought worlds, contrasting the exploitative innovation culture with the culture of exploration. Here, the physical space is a way to support or protect might be more suitable, the two thought worlds.

The physical objects create a barrier, which protects a moment in time, time for an informal conversation. The coffee breaks are a part of the company organisation, but not a part of an overt strategy for improvement of work, so the breaks are not working as a tactical differentiation on an organisational level (Adler et al., 1999). They are instead an emerging spatial differentiation between two innovation cultures.

The little coherence in the choice of material or colour scheme was typical for all the images of coffee rooms. In the lean culture of the companies, it is important to reduce waste and not to create waste, which creates an incentive to use what they have. The furniture is not valued for communicating a design style; it is there for its function. There are, thus, similarities between the relation to objects in production and in the coffee room, which can contribute to the relaxed feeling. To provide a sense of security, the furniture and the objects in the spaces cannot be too different from the ways of thinking about objects and workspace in production. The coffee room has here a function-based design; the things in it are the things that are used and primarily chosen based on their functionality. 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; we found no indication that the 5S has entered into the placement of artefacts in the coffee rooms.

**Motifs with characteristics of external input**

A few examples of spaces were connected to external input, (besides the already presented coffee rooms that show some examples of external input): a telephone conversation, a lounge area, a photo of a reception area, production at night, two images of cars and corridors in production. Those motifs were either embracing external input or closing it out. External input is important to developing new ideas and internal input to the dissemination of ideas. External input is important for innovation, when it creates connections between different thought worlds.

The motif of the reception was photographed by a storage worker at Company 2, who had worked over 10 years in the company (informant 2:1). The reception area consists of a small space immediately to the left of the entryway to the building. It is easy to pass by without noticing it. In the photograph, the reception area was empty, and the furniture was a visitor’s chair in dark wood with light blue seat, probably from the late ’90s, two tables in a light wood colour with white legs, which were put together, a computer screen, and a computer with its back towards a visitor. There were some documents, a waste bin, an office chair, and shelves in wood laminate, one empty and another filled with binders. 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 positive feedback, she continued and said this was the first impression people had of their company: it was black and the light was out.

Informant 3:3, the owner of company 3 and the production manager, took a photo of a car that was also connected to external input. He said that a great many people telephoned him, but he had no strategy for choosing whether a contact was important. He said if it is a bad day he says no to everyone trying to give him external input via the telephone. He said he thought of new ideas about production at night, when he goes into the production area when it’s calm, or when he drives his car. He described the car as a good place to come up with new ideas because it is comfortable, has music, and brings him to new places. There also is a sense of acceleration and he has time on his own.

Informant 4:2 took a photo of a car that was also connected to freedom of thought. He said that a car is a good place for two people to discuss solutions without being disturbed, especially if they are going to their job. They can 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, that part is wiped away.

JS: And then you wrote ... impressions?

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 then 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 examples, each (from two different companies) were used to illustrate the corridors in the production units as hindering innovation because they did not allow for external input, 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 production of all the storages units and passages and said that ‘design of production tells you to be square and to work, work, work’.

In the empirical material there were few spaces for external input, and few workers and managers did naturally connect innovation with places for external input. Informant 2.1 was not sure if the reception area really could have something to do with innovation. Still, the informant chose to photograph it as hindering innovation, referring to external relations to customers and called the entrance dark, giving an impression that it was not open to visitors and customers.

In the case of the car motif, it seems that stress makes external input hard to handle in the office and the production area during the day. Being in a car provides time for reflection 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. The car is external to the factory; it is an enclosed structure that can accelerate to new places provides a space that the informant did not find within the factory. The car is moving away from the factory; there is a need for a physical separation to go into another mode of thinking, which other examples show is not possible in the production environment.

**Motifs with characteristics of risk taking**

We found an example of risk taking, a space that informant 6.1 called an ‘illegal meeting space’. It was a table and some chairs in the production unit in an unapproved area. The informant said it was a space without expectations, it was spontaneous, illegal, had no limitations 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 organise objects in lean production, which is dominated by standards and rules. Here the rules for placement were violated and in the thought world of the informant become ‘illegal’. This space, which was created on the users’ initiative, forced itself into the dominant exploitative culture and while, it was not approved by management, neither was it taken away (informant 6.1).

**Discussion**

The employees did not photograph many motifs that could be a part of an explorative culture. This could be explained in different ways. In the introduction, we mentioned theories about the meaning of unspoken roles and how they might affects the working space (Schein 1984). In manufacturing, in the production units studied, the hidden cultural conventions and the explicit culture of continuous improvement work, strongly affect the design of the factory and other workspaces. Additionally, the production unit may offer few opportunities or support for employees to create their own mental space and time for more explorative innovation activities because the unit can be dangerous place and people have to pay attention to avoid being hurt.

One criticism of the study is that examples in the factory of spaces for explorative innovation may not have been photographed; in other words, the method used may have missed important places for explorative innovation. However, even if such places exist they are *not coming forward* in the material. To use the notion of thought worlds (Fleck,
1979; Dougherty, 1992), we interpret our results to indicate that an employee in a thought world dominated by the central idea or action of exploitative innovation are less inclined to view spaces for explorative innovation as having meaning in relation to innovation.

For our informants, workshop and office spaces are spaces of doing and not of materiality, which could make it hard for them to reflect over a workspace and its relation to innovation. The perception of space is multimodal, but it does not necessarily lead to reflections on its materiality or the spaces relation to improvements or innovations in everyday work, because the employees do not see the spaces and objects materiality when experienced as ‘ready-to-hand’. However, the camera and the interviews introduced a way to reflect on the design and materiality of the workspaces, a new way of reflecting on the spaces as ‘present-at-hand’. Experiencing the space from inside could be related to Heidegger’s concept that in the practice of work the employee understands things as part of a tool-complex within a space where the things refer to each other and experiences, feeling, and thoughts, thus, constitute the cultures.

Another reason why the employees did not photograph many artefacts that could be a part of an explorative culture is the difficulty of developing and handling ambidexterity. The few examples indicated that there is a separation between exploitative and explorative activities in company structures. In other words, the culture of explorative innovation is not prioritized in production, though radical innovation might be driven by explorative innovation in some other department, for example, the product development department.

The examples of motifs that relate to an explorative culture are interesting from the point of view of ambidexterity because they show how two different cultures of innovation act to coexist. The way in which coexistence is lived and experienced from the perspective of individuals makes the relation between integrating and separating explorative and exploitative cultures come forward. The results indicate a complementary strategy, here called differentiation, which makes it possible for the two thought worlds to be integrated in one individual. The differentiation is on the spatial level in the organisational structure in production. The findings in this study point to a spatial differentiation between spaces for explorative culture and exploitative culture. The spaces and objects related to the explorative culture are artefacts within a culture that are marginalised. We argue that they can coexist in the factory within a dominating culture of exploitative innovation because they take on different characteristics when used: undercover spaces, grey zone spaces, satellite spaces, chameleon spaces, temporary spaces and accession spaces (see Fig.2).
Figure 2: Six different characteristics of use found in the material, of spaces for explorative culture that coexists in the factory premises within a dominating culture of exploitative innovation.

The result from the study indicates a need for spaces that provides protection for the individual and group that want to develop an explorative culture in an exploitative. The lean system developed for exploitative innovation is transparent and controlled and as a result does not offer a lot of possibilities for spaces supporting an explorative innovation culture to emerge. We see transparency and integrity as a central point of the spatial design and management of explorative innovation. From a design perspective, the interpretation of the results into strategies or guidelines for solutions is delicate because to culture for explorative innovation does not thrive in being managed in a controlled,
mechanical way (Peschl & Fundneider, 2012). One recommendation could be to create spaces enabling explorative innovation in a participatory design process and in that process identify undercover spaces, grey zone spaces, chameleon spaces, encourage satellite spaces to emerge, provide spaces easily reconfigurable, and identify and explore the spaces with a potential for reinforcing external communication.

**Conclusion**

This study highlights the lived experience of production units and shows individual attitudes to workplaces and innovation. The results show that in a culture of exploitive innovation, there are places that enable a possible coexistence with a culture for explorative innovation.

The results indicate that employees tend to practice what we call ‘spatial differentiation’ to be able to hold two contradictory cultures in a workplace, where one culture is dominant. We found six forms of characteristics of the use of spatial differentiation that support ambidexterity on the individual level: undercover spaces, grey zone spaces, satellite spaces, chameleon spaces, temporary spaces and accession spaces. 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 spaces for explorative innovation in all parts of the organisation. The pattern in the characteristics of the use of spatial differentiation has to be followed up by future research. One interesting direction for future research is to study if the results translate to non-manufacturing companies.

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