

# Exploring ways to study the workplace design in a small knowledge work company

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## Abstract

**Purpose** – This study aims to find ways to bridge the gap between workplace design and research. Exploring the design process from general design aims to site-specific design makes the process visible to support workplace design research.

**Design/methodology/approach** – Participatory design methods were used to understand employees' needs and preferences in work-related situations to support the design process. The design process was divided into three phases. The office was temporarily refurbished for the intervention study, and evaluation data was collected with qualitative methods.

**Findings** – Participatory design-generated data revealed typical knowledge work needs, such as the need for privacy, interaction, exposure and preferences for the atmosphere in the workspaces during different situations. The authors identified the following key points to obtain design data: design aims, affordance design and site-specific multidimensional design. An intervention study in a small organisation revealed that lack of activity-supporting spaces created undesirable overlaps for focused work, collaborative work and client communication.

**Research limitations/implications** – The findings of this paper are explorative and limited to a small knowledge work company. The present approach identifies valuable data collection points in different design phases of workplace design processes. Sharing knowledge from practice to research and vice versa could inform research and improve workplace design.

**Originality/value** – This study makes the workplace design phases more visible. It supports finding new ways to study the connection between the user-needs and workplaces; and understanding how different design solutions impact workplace experiences, such as satisfaction. This study also brings focus to understanding the versatile needs of small organisations and their workplace design.

**Keywords** Workplace design, Participatory design, User-centred design, Affordance mapping, Intervention, Need-supply fit

**Paper type** Research paper

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## 1. Introduction

Understanding the workplace design factors and their effect on work environment satisfaction has become an increasingly important area of enquiry. Comparative research of the same office typologies, such as activity-based work environments, has revealed conflicting outcomes (Brunia *et al.*, 2016; Colenberg *et al.*, 2020). From the design perspective, the best understood known factors appear to be the level of openness of space and space division, which affect the employees' sense of privacy and social interaction (Brunia *et al.*, 2016; Hoendervanger *et al.*, 2018). However, remarkably few studies have sought to study workplace interior design and its impact on satisfaction in more detail. The unique arrangements of architectural and interior design elements and ambient factors create combinations, which support or hinder employees' satisfaction with their environment (De Been and Beijer, 2014; Brunia *et al.*, 2016; Bodin Danielsson, 2019; Colenberg *et al.*, 2020). Available knowledge concerning workplace satisfaction is from research studies conducted in small and medium-sized enterprises (SME, 10 to 249 employees) (Gerdenitsch *et al.*, 2018; Rolfö 2018), large organisations (over 250 employees) (Hoendervanger *et al.*, 2019) or combination of various sized organisations (Brunia *et al.*, 2016; Hoendervanger *et al.*, 2016). The quantitative methods often exclude locational factors, such as interior design. However, locational factors are still considered to have a dominant influence on work environment satisfaction (Hoendervanger *et al.*, 2016). Organisational change and office design processes increasingly occur with future occupants as participants in the process. Unfortunately, these processes are rarely documented in their design stages (Rolfö *et al.*, 2017).

We are interested in understanding the workplace design processes and how their outcomes impact workplace satisfaction. There is a recognised gap in knowledge concerning the design processes and the detailed analysis of studied office environments (Brunia *et al.*, 2016; Gjerland *et al.*, 2019; Colenberg *et al.*, 2020). We have completed a workplace intervention study using a participatory design approach to understand the design process and its research. While the intervention study and its design produced organisation-specific data, it revealed informative points in the design process to research in the future. The context of research, a small start-up company, enabled us to approach the research from a very detailed perspective. Understanding the needs of small offices is essential, as the micro (1–9 employees) and small companies (10–49 employees) represent more than 95% of firms in many economies (Crisuolo *et al.*, 2014). With a low number of research participants, we could test and explore research methods to understand how workplace design processes and outcomes could be researched.

## 2. Literature review

The employees' satisfaction towards their work environment is dependent on the extent to which the physical work environment meets the employees' needs (Van der Voordt, 2004). Modification of person–environment fit theory (Edwards *et al.*, 1998), the need–supply fit model (Kristof-Brown *et al.*, 2005), describes the match between the employee's needs and the supplies of the environment. For need–supply fit to occur, workspaces should provide the appropriate physical and functional conditions that match the task-related needs. Depending on the task complexity, different individual and collaborative tasks require different social dimensions supported by the physical work environment. The environmental structures, elements and layout can either protect, allow or even promote exposure to distractions and stimuli (Heerwagen *et al.*, 2004). For now, the need–supply fit has been mainly studied in the context of activity-based offices, which support different individual and collaborative tasks by implementing open or enclosed workspaces (Bodin Danielsson and Bodin, 2008; Boutellier *et al.*, 2008; Appel-Meulenbroek *et al.*, 2011; Wohlers and Hertel, 2017).

When an activity-based flexible office supports the need–supply fit formation, it may increase the employees’ satisfaction towards their environment, decrease distractions and increase interaction (Gerdenitsch *et al.*, 2018). Approaching the need–supply fit formation from participatory design and perspective may improve understanding of workspaces that support employees in finding the right fit and, thus, enhance environmental satisfaction.

The office layout (e.g. single-cell office, shared office, open-plan office, combi-office and flexi/activity-based office) is a dominant factor when different outcomes (e.g. satisfaction) are measured (Bodin Danielsson and Bodin, 2008; Bodin Danielsson, 2019). Workplace design research requires attention beyond the distinction of private and shared spaces to understand the connection between workplace design and the formation of satisfaction and need–supply fit. Maier *et al.* (2009) proposed that affordances could be used as a conceptual framework to understand the relationship between environments and occupants (Maier *et al.*, 2009). Gibson (2015) originally coined the term affordance as actionable properties that the environment offers to an animal. Norman (1999, 2013) extended affordance thinking towards man-made objects and relationships between design and use. Withagen *et al.* (2012), on the other hand, propose an interesting idea of affordances that could invite behaviour. Mapping the action patterns and constraints supports the recognition of affordances and misaffordances and enables testing and contesting building function and usability early in the design phase (Koutamanis, 2006).

Architectural details and their combination create outcomes that complicate a direct comparison of work environments, regardless of the office type (Cordero *et al.*, 2019). Chafi *et al.*, for example, applied in their work artefact ecologies to elucidate the framework of functional, social, emotional and symbolic features in a workplace to analyse the distinction between desirable and undesirable workstations (Bødker and Klokmoose, 2012; Chafi *et al.*, 2020). For our study, we chose to inspect the workplace design through a multidimensional framework of instrumental, symbolic and aesthetic dimensions (Rafaeli and Vilnai-Yavetz, 2004; Vilnai-Yavetz *et al.*, 2005; Elsbach and Pratt, 2007). Instrumentality refers to how artefacts and their arrangement contribute to performance or promoting goals (Rafaeli and Vilnai-Yavetz, 2004; Elsbach and Pratt, 2007). This dimension is closely related to affordances. A chair is a single artefact in an office environment, or it can create an affordance for sitting. The instrumental dimension extends into a workstation, an entity of a chair, table and tools, that form an affordance for working. The workplace layout and its enclosed and open spaces belong to an instrumental dimension (Rafaeli and Vilnai-Yavetz, 2004; Elsbach and Stigliani, 2019). The aesthetic dimension consists of elements, such as colours, textures, forms and the complexity of their arrangement, which create a sensory experience and influence the attractiveness of a space (Rafaeli and Vilnai-Yavetz, 2004; Sander *et al.*, 2014). The third dimension, symbolic, elicits the meaning or associations (Rafaeli and Vilnai-Yavetz, 2004; Elsbach and Stigliani, 2019). Interestingly, the symbolic dimension can convey how space could be used; for example, different furniture settings may transmit a message of formality or playfulness.

### 3. Materials and methods

This multidisciplinary project set out to study how the work environment can support collaborative knowledge sharing and problem-solving. The research context was a growing start-up company. Typologically, the settings of two shared office rooms resembled a team office (Duffy and Powell, 1997; Bodin Danielsson and Bodin, 2008). This paper presents the study’s architectural focus: how user-generated data can inform workplace design and how the design outcomes can be tested in a work environment. The methodological framework has been discussed in (Markkanen and Herneoja, 2018). The detailed lighting design is presented in (Markkanen *et al.*, 2017).

This study consists of a participatory design phase and an intervention study. Participatory design has been widely used in design areas such as interaction design, planning processes, arts and architectural design. We use participatory design methods to understand everyday settings through the participants' perspective in a holistic manner and create opportunities for mutual learning (Blomberg and Karasti, 2012). Therefore, our workplace design research is positioned into ethnographic and holistic understanding. The participatory design process establishes real-life problem situations, and through gathering information, we reveal organisational practices and identify the needs and wishes of participants (Bratteteig *et al.*, 2013). The gained knowledge is tested and evaluated with an intervention study. When the future users of the design are given the "experience expert" positions, they can influence the idea generation, knowledge development and the design outcomes. Nevertheless, designers have an essential role in providing tools for ideation and expression in a co-design process. For the final design, the designers play a critical role in form-giving to the ideas and their implementation (Sanders and Stappers, 2008). The participatory design approach in larger organisations is problematic because of limited participant groups; applying participatory design in a small company enables a more thorough understanding of organisational needs (Robertson, 1996). Even though designing is a creative process, it is also goal-oriented and involves multiple perspectives. Because of its creativity, design cannot be made into an exact, replicable science (Olsen and Heaton, 2010). Therefore, we aim to make key points of the design process more visible to make design data researchable.

The participatory design methods, interviews and a workshop were selected to support the design process and planned to reveal participants' roles in the company, work environment, daily tasks, organisational habits and environmental needs. The data was first used to set the design aims, which were then developed into affordances and eventually into the site-specific intervention design. In the context of this study, the intervention refers to a temporary refurbishment of participants' workplace. It was conducted to understand how participants experienced deployed affordances. The changes were evaluated during the 12-week intervention using qualitative methods, evaluation probes and a workshop. Evaluation probes were used to collect data *in situ* in the researcher's absence (Luusua *et al.*, 2015). At the end of the intervention period, the workshop enabled participants to share their experiences.

### 3.1 Organisation and participants

The ICT-service-providing company was recruited through a start-up incubator in 2016. The participatory design phase was conducted in autumn 2016. The 12-week intervention study was organised in the company's premises for 12-weeks during February–April 2017, during which evaluation took place. Three co-founders and seven employees participated in the study ( $n = 10$ ). A total of 80% of the participants were male and 20% were female, aged 23–47. During the beginning of the participatory design phase, the company rented Rooms 2 and 3 (Figure 1). It then moved into Rooms 1 and 2 with the possibility of renting Room 3. The intervention was designed for Rooms 1, 2 and 3, but constructed only to Rooms 1 and 2 and an informal meeting area of 65 m<sup>2</sup>.

### 3.2 Participatory design

**3.2.1 Semi-structured interviews.** Participants ( $n = 5$ ) were invited to a semi-structured interview. The interviews were held in the company's premises after workdays and lasted, on average, 60 min. The questions addressed the following themes:



**Figure 1.**  
Affordance mapping  
and images of  
deployed intervention

**Notes:** (A) Floorplan and designed affordances (see Table 1 for a list of affordances). (B, C, D, F, G) Images of Room 1, (I, J) Room 2 and (E, H) informal meeting area

- job descriptions, daily tasks and habits;
- current workspaces, privacy, collaboration opportunities;
- production of new knowledge in the organisation; and
- dream office.

The interviews were audio-recorded and transcribed. The transcribes were iteratively read to identify tasks, daily activities and needs to support the design process.

*3.2.2 Participatory design workshop.* Participants were invited to a participatory design workshop ( $n = 3$ ) to explore different situations in terms of activities, experiences and feelings. The workshop was structured as follows: first, the participants were asked individually to explore their “favourite place” outside work. Next, the participants were asked to describe their “perfect workday” through their daily situations and tasks. The

results of the first two assignments were discussed, and different daily activities were collected. For the third assignment, the participants were asked to select three often occurring situations and explore them with the following prompts: “What is space like? What is the atmosphere like? How do you feel in the situation?” Participants were instructed to use the places, the atmospheres and the moods discovered in the previous tasks. After completing the third task, participants were asked to explore how their “dream office” would support these situations. Participants used floorplans and print-out furniture to help the ideation process and describe workspaces for explored situations. The workshop was audio- and video-recorded.

*3.2.3 Analysis of semi-structured interviews and participatory design workshop.* The semi-structured interview transcribes and the workshop recordings were analysed deductively to identify the following themes necessary to understand the design context: the job descriptions, tasks and different work-related situations. First, the interview transcribes were familiarised to get a comprehensive understanding of the work in the company. Next, the different job descriptions were identified based on interviewees’ roles in the company. Tasks and work-related situations were coded from interview transcribes and workshop recordings and grouped into individual work situations, collaborative work situations and client communication events. The needs and preferences related to these situations were documented. The participants’ discussion from the third assignment in the workshop was documented, and data were categorised as needs, atmosphere and description of dream office.

*3.2.4 Design.* First, the general design aims were formed based on tasks and user-needs. Next, affordances were determined to support more task-specific user-needs. Affordance design was integrated with the spatial design. During this study phase, the design area included Rooms 1, 2 and 3 and the informal meeting area [see [Figure 1\(A\)](#)].

### *3.3 Intervention study*

The intervention study consisted of the complete refurbishment of the participants’ office based on the participatory design data in Rooms 1, 2 and the informal meeting area. The following changes were made during two weeks before the intervention: lighting installation, painting, wall- and ceiling-mounted acoustic elements. Also, furniture, phone booth, drawing boards, curtains and carpets were installed. Lounge furniture and acoustic elements of workstations were installed after the intervention kick-off because of delivery delays.

### *3.4 Evaluation of the intervention*

*3.4.1 Evaluation probes.* The evaluation probes were A5-sized notebooks featuring images of the intervention, spaces and details. The probes contained open-ended question groups with detailed floorplans, enabling markings concerning questions. The first evaluation probe (EP1, delivered on Week 3) themes included first impressions of intervention, changes in working, experiences of workstations, workstation organisation, different spaces and experiences of furniture, colours, materials and lighting. The second probe (EP2, delivered on Week 7) inquired of participants’ experiences after an initial adjustment to the changes. Participants were asked about preferred and distressing intervention features, new ways to use the spaces and how they use different visualisation tools. Also, experiences of auditory and visual privacy, exposure and withdrawal were inquired. The return rate of evaluation probes was 9/10 for the EP1 and 8/10 for the EP2.

*3.4.2 Evaluation workshop.* The evaluation workshop was organised on week 12 ( $n = 7$ ) to complement data on probes. First, the participants wrote down their observations and

placed them on a printed floorplan. Next, the participants were asked to discuss the location of different situations in shared work environments and address these situations from the perspective of concentration, communication and working with the client in the shared work environment. Finally, the participants discussed the required changes in the intervention setup.

*3.4.3 Analysis of evaluation.* The intervention design and deployment were holistic, and, therefore, we approached the analysis through a bottom-up inquiry. First, the data sets from the evaluation probes and workshop were carefully studied. Different approaches were tested to analyse the evaluation probes; for example, the experiences of different deployed elements were coded. To understand the experience of the intervention and its impact on different tasks and situations, an approach to analysing it through the following viewpoints were selected: deployed affordances and ambient improvements. Workshop recordings were analysed to confirm the evaluation probe findings.

## 4. Findings

### *4.1 User-centred understanding of task-related needs through the participatory design process*

The following task-groups emerged from the interviews' qualitative content analysis and the participatory design workshop:

- Project work: Teamwork consisting of individual work with collaborative planning and problem-solving.
- Client communication: Project development and delivery processes.
- Communication and marketing: Collaborative planning, followed by individual task completion.
- Management: Collaborative and individual tasks with high requirements for privacy.
- Recruitment processes: Contacting people, application management, recruitment interviews and initiation guidance.

Participatory design workshop participants identified the following individual work situations:

- "Concentration-intensive work and demanding problem-solving" requiring a distraction-free environment.
- "Together alone", during which occasional help in problem-solving was necessary for efficient work.
- "Task completion", during which participants finished their tasks.

The collaborative work situations varied in terms of how many participated and length:

- *Ad hoc* problem-solving (see "Together alone"), where two participants briefly collaborate to find a solution to a problem.
- Collaborative work, during which participants work together on a predetermined task.
- Team meetings for general knowledge sharing.

The client communication situations typically occurred through phone or videoconference calls. Also, different recovery situations, such as lunch and coffee breaks, were brought up.

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Workshop participants were asked to choose three situations to discuss in terms of mood and spatial atmosphere. They were encouraged to ideate the work environment for these situations. Following task-related needs regarding privacy, interaction, exposure and atmosphere were discussed:

*Situation 1:* Demanding problem-solving alone:

- Needs: Individual work with a high need for privacy and a distraction-free environment.
- Atmosphere: Peaceful, calm and light. Focus is effortless to attain and maintain.
- Dream office: Sense of spaciousness of a mountain or a sea. Spaciousness can be achieved with a glass wall. Workstations have outdoor views of nature. Acoustic screens or separating walls between workstations. The space is easy to access, and there is a sense of control of the space and the use of time. The colours are neutral and light. Lighting can be controlled: options for dim and bright light.

*Situation 2:* Brainstorming and collaborative problem-solving:

- Needs: Collaborative work with a low need for privacy. Participants can join the discussion and leave freely.
- Atmosphere: Free, relaxed, playful and joyous. Sense of togetherness, achieving together and trust. There is a freedom to express “flying ideas and stupid ideas”. There is no schedule or goal.
- Dream office: The space is loud and informal; it is free-form and multifunctional. The view behind the glass wall is of a big lively city. There is a lounge-style sofa corner with a screen, game console and fireplace. There is a high table with bar chairs and a whiteboard to visualise ideas. Space should have an option to exercise. The space is easily accessible, and people can come and go as they please. The environment is visually rich and stimulating. The lighting is controllable by different areas in the space.

*Situation 3:* Remote client meeting with a set schedule and goal:

- Needs: One or more participants with a high need for privacy and a distraction-free environment. Conversation through the phone- or video conference call.
- Atmosphere: The focus level is intense. The situation requires problem-solving “on-the-go”. The mood ranges from “despair to satisfaction”. There are a schedule and a goal.
- Dream office: The space is calm and gives a positive impression of the organisation for the client, and it can be used as a meeting room. Space is enclosed and distraction-free to create a private environment. The tools include video conference facilities, a computer, and headphones. The functionality of the equipment is essential. There are also single-person workstations with suitable privacy for video conferences.

#### *4.2 Design aims, affordance design and site-specific multidimensional design*

The participatory design workshop generated rich material for the design process, which was iteratively studied and derived into design aims:

- support individual work;

- support *ad hoc* problem-solving and collaboration;
- support collaboration and brainstorming; and
- support client communication.

Also, we aimed to:

- improve lighting and
- improve acoustic properties of the environment.

The design aims are abstract, non-contextual and they do not offer a solution. To make the following design phases more visible, we apply affordances as design units to respond to the task-related user-needs (Table 1). Here, the affordances are descriptions that contain user-needs and/or task-related supplies, which describe initial design solutions that can be used in the design process as non-contextual descriptions. The affordances are linked to the instrumental dimension (described in Table 1). The combination of affordance and instrumental design descriptions enables discussion of design solutions in a general manner. Also, the symbolic and aesthetic dimensions (described in Table 1) were designed during this phase using the workshop discussions of atmosphere as design inspiration. Figure 1(A) shows the final site-specific design as a traditional floorplan through the instrumental dimension. Figure 1(B)–(J) shows the photos of the constructed intervention: the comprehensive design consisting of instrumental, symbolic and aesthetic dimensions.

#### 4.3 Evaluation of intervention

The participants were asked to report their experiences of deployed changes in evaluation probes. The evaluation probe responses were thematically analysed through experiences of affordances and experiences of lighting and acoustics. The evaluation workshop results were combined with this analysis, and the new aspects arising from the workshop are stated. The evaluation results are presented in Table 2. The deployed affordances supported individual work that benefitted from *ad hoc* problem-solving with co-workers through a face-to-face seating arrangement. Unsuitable fits between the use of spaces and deployed affordances were detected: the shared spaces were used for individual and group activities, thus hindering individual work that required concentration. The overlap of activities might have been solved with the Room 3 affordances that supported high-focus work and collaborative and remote meeting situations. An additional workspace would have added flexibility to comprise simultaneously ongoing activities in the office.

### 5. Conclusions

The design process defines significant features and subsequent use of offices (Ruohomäki *et al.*, 2015; Rolfö, 2018). Our participatory design and intervention study tactic to workplace design research differ from typical, such as investigating existing work environments (for example, Brunia *et al.*, 2016), relocation studies (Rolfö, 2018) or focused interventions to a specific element of the work environment. However, a holistic understanding of the workplace design processes and decisions are invaluable to improve future workplaces.

This research had two parallel knowledge interests: understanding workplace design processes and testing a participatory design-generated workplace design in an intervention study. While the intervention research generated organisation-specific information, the methodological framework opens opportunities to collect design data for both design and research purposes.

Space	Affordances	Instrumental dimension	Symbolic dimension	Aesthetic dimension
Room 1	<ul style="list-style-type: none"> <li>1) Support awareness and <i>ad hoc</i> problem-solving with face-to-face seating arrangement</li> <li>2) Support collaboration with visualisation tools and furniture</li> </ul>	<ul style="list-style-type: none"> <li>The face-to-face seating arrangement of workstations with high visibility</li> <li>Separate workstation set-up for brief problem-solving events</li> <li>Drawing board</li> <li>Separated from informal meeting area with a curtain</li> <li>The face-to-face seating arrangement of workstations with high partitions for increased privacy</li> <li>Drawing board</li> </ul>	<ul style="list-style-type: none"> <li>“Forest”</li> <li>Casual and home-like</li> <li>“Park”</li> </ul>	<ul style="list-style-type: none"> <li>Rich to support a comfortable and home-like atmosphere</li> <li>Textiles with autumnal colours (greys, green, orange, purple)</li> <li>Colourful carpets</li> <li>Lean to support the calm atmosphere</li> </ul>
Room 2	<ul style="list-style-type: none"> <li>3) Support focused work in multitenant workspace</li> <li>4) Support confidential tasks with increased visual privacy</li> </ul>	<ul style="list-style-type: none"> <li>Separated from informal meeting area with a curtain</li> <li>The face-to-face seating arrangement of workstations with high partitions for increased privacy</li> <li>Drawing board</li> </ul>	<ul style="list-style-type: none"> <li>“Park”</li> </ul>	<ul style="list-style-type: none"> <li>Lean to support the calm atmosphere</li> <li>Dusty green wall and plywood tree</li> </ul>
Room 3	<ul style="list-style-type: none"> <li>2) Support collaboration with visualisation tools</li> <li>5) Support high-focus work with additional workstations</li> <li>6) Support collaboration and meetings through a workspace</li> <li>7) Support individual and group phone- and video-conference meetings with a workspace</li> </ul>	<ul style="list-style-type: none"> <li>Enclosed and distraction-free space</li> <li>Workstations with high partitions for focused individual work</li> <li>High meeting table for collaboration</li> <li>Tools for videoconference meetings</li> <li>Wall-mounted drawing board</li> <li>Separated from Room 1 with a curtain</li> </ul>	<ul style="list-style-type: none"> <li>Peaceful, calm and light</li> <li>“City”</li> <li>Formal and calm</li> </ul>	<ul style="list-style-type: none"> <li>Partitions in different shades of green and blue</li> <li>Lean to support formal atmosphere</li> <li>Dusty colours</li> <li>Wall-mounted drawing board with city view</li> </ul>
Informal meeting area	<ul style="list-style-type: none"> <li>8) Support group meetings with a workspace</li> <li>9) Support recovery with relaxing space</li> <li>10) Support client communication events with phonebooth</li> <li>2) Support collaboration with visualisation tools</li> </ul>	<ul style="list-style-type: none"> <li>Separated from Room 1 with a curtain</li> <li>Couch, chairs and rocking chairs with side tables</li> <li>Wall-mounted drawing board for problem-solving</li> <li>Phonebooth for individual phone meetings</li> </ul>	<ul style="list-style-type: none"> <li>“Mountain cabin”</li> <li>Playful and relaxed</li> </ul>	<ul style="list-style-type: none"> <li>Rich and colourful to support a playful atmosphere</li> <li>Wall-mounted drawing board with nature visualisation</li> </ul>

**Table 1.**  
Designed affordances  
and workspace  
features

**Table 2.**  
Evaluation of  
affordances, lighting  
and acoustic  
conditions

Affordances	Evaluation results from evaluation probes (EP) and workshop
1) Support awareness and <i>ad hoc</i> problem solving with face-to-face seating arrangement	Participants reported increased communication (7/8) (EP2). All participants reported an increased awareness of others. The seating arrangement and increased awareness decreased the threshold to ask questions, and request collaboration-supported problem-solving (workshop) [Figures 1(b) and (f)]
2) Support collaboration with visualisation tools and furniture	Participants (3/8) reported having used drawing boards (EP2) [Figure 1(e) and (g)]. Drawing boards support the projects' design phase. Still, it is more productive to use the computer during the implementation phase to test solutions on-the-go (workshop)
3) Support focused work in a multitenant workspace	Participants in Room 2 reported (EP2) that the room supported focused work equally to prior intervention (1/4), the acoustics was slightly better (1/4). Still, phone- or videoconferences frequently caused distractions (2/4). Acoustic screens [Figure 1(f)] provided privacy (2/4) and a "nest-like" feeling to the workstation (1/4). Room 1 participants stated that focused work was hindered (4/4), 6/8 participants stated that the intervention does not support focused work because of noise, discussions, proximity, routing and phone- or videoconferences
4) Support confidential tasks with increased visual privacy	Room 2 participants seated next to the outside wall positively reviewed the visual privacy of their workstations (EP2). Exposed computer screens lead to a lack of visual privacy and the need to hide confidential material [Figure 1(b)]
8) Support group meetings with a workspace	All participants reported morning meetings (EP1). The space was also used for one-to-one discussions and problem-solving [Figure 1(e) and (h)]
9) Support recovery with relaxing space	The space was also used for social gatherings. The design was reported as comfortable and peaceful
10) Support client communication events with phonebooth	The phonebooth was tested by (5/9); its privacy was insufficient as the voices carried through to nearby workstations (3/9). Participants (8/9) reported a preference for using their workstations for either phone or videoconference calls (EP2) as they needed a computer [Figure 1(h)]
Lighting	The participants positively reviewed lighting in the intervention and at the workstation (8/9). One participant considered the light to be too bright at their workstation. The lighting evaluation results will be published in more detail elsewhere (Markkamen <i>et al.</i> , submitted for publication)
Acoustics	The participants (5/8) perceived that wall- and ceiling-mounted acoustic boards, curtains and carpets positively decreased echoes in workspaces. The changes in acoustics were not measured

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First, we studied the user-needs with participatory design by analysing participants' daily habits, individual and collaborative tasks and client communication. Our findings revealed that task-related needs differed in privacy, interaction, exposure and atmosphere. These were in line with previous research, which showed that a perceived fit towards the environment occurs through the combination of activity, task-complexity and personal need for privacy (Hoendervanger *et al.*, 2019).

Design processes are negotiations between problems and solutions through repeating cycles of analysis, synthesis and evaluation (Lawson, 2006, p. 47). We aimed to pause these cycles of design solution development in points to provide opportunities to reflect and collect design data. The design process revealed three different points that could inform workplace research:

- (1) design aims;
- (2) affordance design; and
- (3) site-specific design.

In the first phase of the design process, the initial design problems are described as design aims. For example, the design aim of "Support *ad hoc* problem solving and collaboration" responds to the often-occurring situations in the company when co-workers' help is needed to proceed. Accumulating such task- and situation-related design aims from office design and refurbishment projects could inform researchers more about user-needs.

In the second phase of the design process, we tested the concept of affordances and their mapping to bridge the gap between the design aims and the final site-specific design. Continuing with the same example, we divided the design aim into affordances: "Promote awareness and *ad hoc* problem-solving with face-to-face seating arrangement" and "Promote collaboration with visualisation tools and furniture". In line with the affordance definition, we aimed to support action possibilities in the workspace. This brief descriptive affordance includes an initial design solution. Affordances can be used as a conceptual framework to understand the relationships between environments and occupants (Maier *et al.*, 2009; Koutamanis, 2006). Keeping the design information brief supports placing different activities within the spaces and detecting possible actions that might hinder the performance of others. Accumulating affordance design information could inform researchers if critical gaps exist in the design process concerning the employees' activities and needs in their work environment.

The third design process phase merges the affordances into the comprehensive design. We present the design outcome (Table 1) through a categorised multidimensional design description (Rafaeli and Vilnai-Yavetz, 2004). The instrumental dimension was designed according to user-needs and affordances. The participatory design workshop discussions inspired symbolic and aesthetic dimensions. The multidimensional analysis brings the interior design needs and solutions in a form that can be used as design data to deepen the understanding of how workplaces are experienced. Using the comprehensive site-specific design as a data collection point brings challenges because of its richness. However, understanding the design through this three-partite framework is important, as all three dimensions affect the final design.

Start-ups and young companies direct their efforts to sustainable growth through employee recruitment and retention. The importance of workplace design in start-ups is not studied. The evaluation methods used in this study revealed that tasks with versatile needs for privacy and communication are performed in shared spaces. Overlapping activities may hinder work and impact workplace satisfaction and work efficiency. This is in line with the previous report of misfits occurring when high-complexity tasks are performed in shared open workspaces (Hoendervanger *et al.*, 2019). Although we could not test in this

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intervention study, Room 3-located affordances and activities probably would have improved possibilities for collaboration, client communication and focused work. While activity-based working has been studied in large organisations, similar needs for privacy and interaction are present in small organisations.

### *5.1 Implications of the study*

Our explorative design study in a small company revealed research opportunities available in different workplace design process phases: design aims, affordance design, and site-specific design. First, the design aims phase combines the data of user-needs concerning the organisation's daily habits. While general task-related user-needs are available in work environment research literature, understanding user-needs in a contextual manner is important for the design process, as workplace-specific user-needs depend on employees' job descriptions. Accumulating such task- and situation-related design aims from office design and refurbishment projects could inform researchers in more detail of user-needs in a versatile manner. Second, when intentionally used as part of the design process, affordance design may inform project stakeholders and researchers if there are critical gaps or misaffordances in the design process concerning the employees' activities and needs in their environment. This is the most interesting data collection point to inform knowledge work environment research: affordances inherently inform of action possibilities. Their mapping provides a tool to estimate their effect on the surroundings. Third, the final design outcome is always site-specific and unique. Comprehensive design is challenging to analyse in more extensive studies, but the situational surroundings significantly impact the employees' satisfaction. Spatial analysis is a process that yields rich data sets. Implementing a shared qualitative research method would support spatial analysis and improve our understanding of locational differences in workplace design to build a shared understanding of workplace design on an experiential level.

### *5.2 Limitations of the study*

To the best of the authors' knowledge, this was our first workplace design study that combined the participatory design and the intervention study; thus, the approach was explorative, and through exploring different methods, we aimed to find appropriate ones for workplace design research. Because of the setup of an intervention study in a company, the number of participants was limited. Using evaluation probes generated a heterogeneous data set: the open-ended questions left room for the participants' interpretation on how to answer. The collected data varied from minimal input to carefully thought answers.

### *5.3 Future research*

This design method framework opens several attractive future research opportunities, such as collecting data from office design processes and testing the benefits of affordance usage in the design process. In small companies, research linking task-specific needs and provided supplies may inform companies how small work environments need to be developed to support company activities and workplace satisfaction optimally. Workplace reorganising is particularly timely because of COVID-19 pandemic enforced changes in knowledge work culture: The priority of workplace research was to manage risk in organisations (Cirrincione *et al.*, 2020, Hou *et al.*, 2021). Upon partial return of employees to workplaces, there is an increased demand for remote communication and collaboration spaces to support hybrid working. Post-pandemic workplace design will need to reconsider the importance of social cohesion and work culture (Pataki-Bittó and Kapusy, 2021) and the impact of workplace attractiveness to motivate employee presence at the office. Therefore, understanding workplace satisfaction will be increasingly essential to

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entice remote working employees to return to the office. The participatory design methodology presented in this paper may support understanding the needed developments on the site-specific level to support workplace satisfaction.

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