

Experience-Driven Design of Ambiences for Future Pop Up Workspaces

Aino Ahtinen, Jenni Poutanen, Maiju Vuolle, Kaisa Väänänen, and Sanna Peltoniemi

Tampere University of Technology, Tampere, Finland
{aino.ahtinen, jenni.poutanen, maiju.vuolle, kaisa.vaananen, sanna.peltoniemi}@tut.fi

Abstract. Knowledge work is in transformation and new means for supporting workers' wellbeing and productivity are needed. Pop Up workspaces are temporary and often social working environments where people can modify their environment to suit their current work mode. The aim of the present research was to explore the opportunities of future Pop Up workspaces, and specifically their technology-mediated ambiances that can provide meaningful experiences for the workers. We employed the Experience-Driven Design (EDD) approach to gain insights of the desired experiences in Pop Up workspaces. We first conducted three participatory group sessions to ideate experience types for Pop Up workspaces. We then run a multidisciplinary conceiving workshop in which we designed concepts for technology-mediated ambiances. Five experience categories for worker mindsets were identified, namely Liberty, Fellowship, Determination, Retreat and Recovery. We present ambience concepts that utilise the mindsets and related target experiences, and how they can be supported by ambient technologies.

Keywords: Pop Up workspaces, Knowledge work, Workspace ambiances, Experience-Driven Design, User Experience, Space design, Ambient technologies

1 Introduction

Knowledge work is facing a crisis – knowledge workers face challenges in managing the amount of the workload, cognitive load, competence challenges and time pressure, and at the same time, the feeling of not being productive enough. The work is changing rapidly due to the emergence of novel technologies and applications, leading to more flexible, mobile and collaborative work practices and spaces, e.g., [1]; [2]. At the same time, the demands for the knowledge workers related to the self-development and productivity are constantly rising, often at the cost of the individual worker's wellbeing. In addition, the sedentary nature of contemporary office work has serious impact to the health of the workers [3].

Our definition for *Pop Up workspaces* is the following: Pop Up workspaces are workspace designs that are temporary, modifiable and often social. Such workspaces aim at increasing both wellbeing and productivity by allowing workers to manipulate their work environment. Wellbeing and work productivity are usually tied together –

the better the wellbeing of the worker, the more productive she is supposed to be. Experimental Pop Up spaces can also be seen as a method of participatory design including user feedback on space development [4]. Designing Pop Up workspaces requires a multidisciplinary approach, as knowledge work is conducted in a system where the physical, virtual, social and emotional work environments meet, e.g., [5]. In order to develop understanding about novel work environments we combine the viewpoints of user experience (UX) design, architecture and knowledge management.

The aim of the research presented in this paper is to explore what kind of experiences people expect in Pop Up workspaces, and how those experiences could be supported by ambience design. The research approach is based on *experience-driven design (EDD)* of Pop Up workspaces. EDD means designing for particular experiences evoked by the usage of everyday products [6]. In this case, the goal is to design workspaces and enable experiences that will increase workers' wellbeing and productivity. We first conducted a participatory design study with brainstorming sessions to ideate meaningful experience types for workspaces. After that, we run a multidisciplinary concepting workshop in which we designed early-phase concepts for the experiences that emerged in the participatory design study.

The resulting concepts take the form of *workspace ambiences* that can be generated with the means of architectural space design and ambient technologies. By ambience we mean the atmosphere of the space. The Pop Up aspect in technologically enabled ambiences is that the atmosphere of the space can be changed based on the user's needs, work task, feelings and other changing aspects of work. It gives more flexibility for the workspaces. Our vision is that the users could select a suitable ambience for their current work mode. The variety of ambiences may support people in getting pleasurable experiences in the workspace, as novelty and change are among the human needs for the good product user experience [7].

As far as we are aware, the experience-driven design approach has so far not been utilized in the design of workspace ambiences. The research questions of this study are the following:

1. *What are the meaningful experiences in Pop Up workspaces for knowledge work?*
2. *How can those experiences be supported with ambiences, which are designed as desired combinations of ambient technology, real-world objects and spatial design?*

2 Related Work

2.1 Workspace Design for Knowledge Workers

Contemporary knowledge work is related to the great variety of skills and the demand of those, such as creativity, innovativeness, focus, task management, sociability, flexibility, adaptability, presentation. Knowledge work needs specific support for various activities, such as the information gathering, storage, transfer, use and application, as well as learning and organizing [8]. Work tasks can range from routine to creative work, include both face-to-face interaction and technology-

mediated work with customers or colleagues, as well as require individual working time and concentration. Due to the independency of time, place and utilization of technology, knowledge work can be done in multiple spaces beyond the traditional office environment. Therefore, there is a need to design more multi-use, multi-purpose workspaces to support interaction, creativity, as well as concentration, in order to improve wellbeing and productivity [2].

The previous demands have led to the development of the increasingly popular activity-based office concept, where employees can choose a workstation most functional for their current activity, but which also matches their preferences [9]. According to Värlander [10], the spatial design of work environments is consisted of *affordances*, which may allow or incline certain behaviors and actions rather than others, and then again may inhibit others. During the nonroutine phases of knowledge work, the layout of work environment can indirectly contribute to productivity, as the sharing of ideas, communication and shared search for alternative solutions are facilitated [11]. However, the lack of possibilities for *personifying* one's workplace is one of the known disadvantages of activity-based offices [9]. It is also noteworthy, that employees' personal preferences influence greatly how certain type of workplaces are used, rather than the ergonomics and ICT facilities [9].

2.2 User Experience and Experience-Driven Design

User experience (UX) has become a mainstream in the design of interactive products and services. The user experiences of products and services are supposed to be pleasurable or satisfying as a result of an UX design process and practises. According to Hassenzahl [12], the product user experience consists of pragmatic and hedonic attributes. By pragmatic attributes, he refers to the functional usability and usefulness of the product, while the hedonic attributes relate to the non-instrumental and emotional needs of the people using the product. Hedonic attributes are strong potentials for pleasure [13].

Experience-driven design (EDD), i.e. *how to design for particular experiences*, is a more scarce approach for product design, although its popularity is rising [14]. In EDD, a specific user experience, or a set of them, form the basis and target of the design process [6]; [15]. EDD intends to evoke particular experiences. Product experience is a multifaceted phenomenon; the first layer is the degree to which the senses are gratified (aesthetic experience), the second consists of the meanings that the users attach to the product (experience of meaning), and the third layer is about the feelings and emotions that are elicited (emotional experience) [6].

Playful experiences framework (PLEX) is a model that consists of 22 playful experience categories [16]. Examples of experience categories of PLEX are *captivation* (forgetting one's surroundings), *discovery* (finding something new or unknown), *nurture* (taking care of oneself or others) and *subversion* (breaking social rules and norms). Many experiences that are included in PLEX are also applicable in wider context of design than just designing interactive products.

2.3 Experience-Driven Space Design

According to Norberg-Schulz [17], the character of a space is essential part of experiencing a place. The character of spaces similar to each other can differ greatly according to the elements defining the spaces. Light, materials, form and structure define the character of a space or place, hence affecting the experience. Essential is also how these elements are constructed. Thus a phenomenology of place, an everyday experience, has to consist of basic modes of construction and their relation to formal expression. [17]

Now, we present a prior design case, where experience-driven design approach has been applied to the space design. A new type of a hospital waiting room was created by Marcus Boesenach [6]. Based on an exploratory study of being ill, the target experiences were defined as following: *pride (self-esteem)*, *peacefulness*, *confidence* and *acceptance*. The final concept design created a synthesis between a spatial unit and a piece of furniture. The new waiting area was supposed to invite the patients to discover its different possibilities of functionality and meaning. The product offered different ways of using it. For example, the design supported for the patient to choose her own level of privacy or openness. Thus, the patient could discover her own personal area and create space that fitted in within her personal concerns.

2.4 Ambience Design

The dictionary definition for ‘ambience’ is “*the atmosphere of the place*” (dictionary.com). Furthermore, ‘atmosphere’ is defined as follows: “*a surrounding or pervading mood, environment, or influence*” (dictionary.com). According to these definitions, ambience involves a place, space or environment, which is surrounded by a certain atmosphere, mood or influence. A concept called *Ambience Design* has been presented by Karjalainen et al. [18]. One of their projects was built around the idea of involving multi-sensory experiences of people into comprehensive environmental design. They describe the concept of Ambience Design, e.g., with the following aspects; it is cross-disciplinary, collaborative, and design for the multi-sensory environment. Ambience Design is also design of atmosphere, which means putting focus on experiences and phenomenality, and it utilizes ubiquitous technology. Adjustability, modifiability, modularity and individuality are the central themes of Ambience Design. [19] These aspects match well with our definition on ambience.

In this article, ambience is defined as “*a multisensory atmosphere and character of space, which is created by the means of ambient technologies, real world objects and spatial design to evoke particular user experiences*”. The technology components that can be utilized when designing multisensory ambiances include, e.g. screens to display visual materials (images, videos, colors, shapes); lighting; speakers for the auditory stimuli; vibration and intelligent materials for the sense of touch; aroma dispensers for the olfactory sense. With the means of above mentioned ambient technologies it is possible to create a space that enables varying ambiances.

In the literature, there exists some cases to present technology-enabled ambiances. For example, Wisneski et al. [20] advocated for moving personal computing

interfaces from small screens towards the comprehensive experience in physical environment with nature-simulating effects. Especially their development, *the ambientROOM*, which “surrounds the user within an augmented environment”, houses similar ideas and ambient experiences to ours. Furthermore, *LiveNature* [21] is an interactive system that connects people with their remote cherished places. The system captures live video streaming and weather data from a cherished place and presents the “sense” of the place in an ambient, aesthetic way on screens in the user’s location. *Scented Pebbles* [22] is a set of interactive lighting objects to create multisensory ambience of light and smell. The lighting objects, pebbles, emit smells and control the lighting conditions to evoke sensorial imagination and generate unique ambiances, such as Hawaiian Sunset or Japanese Onsen. Ip and Kwong [23] present *Smart Ambience Games* for children with learning difficulties. In the smart ambience game, the learners interact through the body movements in a virtual environment that provide visual and auditory stimuli. The learning environment was used, e.g. for virtual painting, experiencing virtual environments, building a favorite surrounding, and dancing. Furthermore, Kuijsters et al. [24] state that changes in light characteristics (tone, color, illuminance) influence the atmosphere and thus, the affective experience of the room. They present work of *affective ambiances created with lighting* for older people visiting care centres, to reduce negative feelings and enhance wellbeing by creating cosy and activating ambiances.

3 Methodology

There were two phases in our study, which followed the challenges of EDD: 1) *to determine what experience(s) to aim for* and 2) *to design the product that is expected to evoke that experience* [6]. Designers and users usually co-create the experiences [25]. Understanding the context, interpretative approach for research and participatory design are among the main issues in defining the experiences [25].

3.1 Participatory Design Study – Exploring User Needs and Determining Experiences

A participatory design (PD) study was arranged *to understand the user needs towards the future Pop Up workspaces and based on them, to determine the meaningful experiences in them*. 14 individuals (F=10, M=4) participated in three brainstorming sessions (4-6 persons/session). They were employees (researchers, secretaries) and students (architecture, pervasive computing and electrical engineering) in one of the largest universities in Finland. They were recruited with email and social media advertisement. The criterion was that they should be knowledge workers, which in this context involved also students. Most participants were 20-35 years old, and three were older than that. All of them used mobile phone, email and internet in a daily basis.

The study consisted of a task that was carried out prior to the group session, where the participants imagined the Pop Up workspace of their dreams. They were guided to

write a short description of the space, e.g: What adjectives describe the space? How does the space look like? How does it sound like? Three brainstorming sessions were arranged to discuss participant's expectations, as well as to construct and try out some aspects of the Pop Up workspaces. In the session, the participants presented their expectations towards Pop Up workspaces, and after that, they collectively formulated a Pop Up space where they would like to work. The space they formulated could include aspects from all participants' expectations. The sessions took place in a room equipped with stimulus materials (furniture, folding screens, cardboard, papers, pens, mockups of devices, drawable walls etc.). The participants were asked to use their imagination and modify the space according to their expectations on Pop Up spaces, and think aloud at the same time. Also, if some aspect they wanted to include in the space was not actually available, they were asked to imagine it and describe it with words, or sketch it. The purpose of the construction task was to activate participants to do a hands-on experiment. The hands-on experiment was expected to free their minds more than just participating a discussion. In the end of the session, there was a wrap-up discussion, where the insights gained during the session were discussed. The participatory design study generated data about the user needs (perceptions, expectations) towards future Pop Up workspaces.

The data of the participatory study was analyzed with the content analysis method [26]. The data was first transcribed word for word and the researcher went through the data and tracked the emerging themes of the meaningful experiences of future workspaces, and their higher-level categories, which we call mindsets. Next, the data was more systematically coded on a spreadsheet. In the analysis, the main question for the data was *"What are the meaningful experiences in future Pop Up workspaces?"* (research question 1). After the systematic coding of data, the researcher conducting the analysis labeled the mindsets and the related meaningful experiences with descriptive names (Table 1).

3.2 Concepting Workshop – Designing for Experiences

In the concepting workshop, five researchers representing UX, architectural space design and knowledge management, participated in conception. Their titles varied from the doctoral student to professor.

The workshop aimed at conception of early phase example solutions for the meaningful experiences and mindsets of Pop Up workspaces: *"How can those experiences be created with ambiances which are designed as desired combinations of ambient technology, real world objects and space design?"* (research question 2). For each mindset, we designed an example ambience that aims at enabling experiences that were involved in that specific mindset. Concerning ambient technologies, the purpose was to utilize the appropriate combinations of existing technological components, and not to design new technological solutions as such.

The moderator first presented the results of the PD study, and presented the definition of the "ambience", as well as a list of possible technologies for ambience design. A moment was first spent for individual ideation, after which the ideas were collectively gone through. A list of ambience enablers for each mindset was created.

Finally, the moderator summarized the ideas. According to those summaries, the visualizations representing each ambience were created afterwards. The summarized data and the visualization of each mindset describe the example ambiances.

4 Findings of the Participatory Study

This section presents the main results analyzed from the participatory study. The data revealed *five experience categories, here called mindsets*, namely *Liberty, Fellowship, Determination, Retreat* and *Recovery*. Those involve the meaningful experiences in the future Pop Up workspaces. The mindsets and experiences are summarized in Table 1. Authentic participant citates are provided in italics.

Table 1. The five mindsets and the related meaningful experiences in Pop Up workspaces.

Liberty	Fellowship	Determination	Retreat	Recovery
Creativity	Encounter	Focus	Independency	Recreation
Inspiration	Being part	Concentration	Peacefulness	Peace of mind
Exploration	Collaboration	Conventionality	Concentration	Wellbeing
Innovation	Closeness	Formality	Safety	Escape
Expression	Connectedness	Peacefulness	Selection	Captivation
Sensation	Cosyness	Discreetness	Feeling	Safety
Freedom	Equality	Being part	connected	Activation
Feeling		Beauty		Nature
energized				experience
Activation				
Variation				
Being part				
Connectedness				

4.1 Mindset 1: Liberty

The first mindset for knowledge work is called *Liberty* intended *for creative, and inspirational, most often collective work*. The Liberty involves the freedom for creative expression (**Creativity**), as well as the feeling of being inspired (**Inspiration**): *“There should be freedom to do!”* (female, 26-30 years). It also includes the experiences of exploring an object, situation or task (**Exploration**), as well as finding a solution for the problem or inventing something new (**Innovation**). The Liberty also involves the freedom to express oneself without the fear of being judged of one’s thoughts in the first phase (**Expression**), as people may feel vulnerable when they are creative: *“When one really wants to throw oneself to the topic, the space needs to create a feeling of safety. Normal official one does not do that.”* (male, 21-25 years)

The space for Liberty is interesting, tempting and casual, calling for individuals to come by. It offers stimulation for all senses (**Sensation**) with the variety of materials, shapes, visuals, colors, sounds and scents: *“The space should take into account*

different senses, and inspire through them." (female, 31-35 years); *"The world of scents could support the characteristics of the space."* (female, 31-35 years)

The space for Liberty is an environment to feel spaciousness and lightness (**Freedom**): *"There should be space for thoughts."* (female, 26-30 years). It is full of sunshine. The space makes one to become mentally active (**Feeling energized**): *"Full of light and sunny, somehow energetic. One would be like, oh, there are good energies to work."* (female, 26-30 years)

In the space for Liberty, there is freedom to work in an active and large way (**Activation**). The participants wished for more activating working habits and a possibility to decrease the amount of sitting during the workday: *"It is somehow old-fashioned way to sit all the time at work."* (female, 50+ years). Working in this space happens mostly by standing and moving in the space. The space supports walking, taking different positions, locations and points of view: *"I agree that one needs to be able to move (in the space). That opens up the creativity."* (male, 21-25 years); *"It should be so that you can physically change your position once in awhile."* (female, 26-30 years).

In addition, the space for Liberty is also strongly associated with the possibility and permission of modification and changing the space (**Variation**). The workspace for Liberty is flexible and allows for modifications for different work tasks, purposes, sizes of groups and moods. The objects, furniture, materials and tools in space can be modified by the workers: *"As people start to use these kinds of novel workspaces, they could be suggested to think a meaningful way of working. They would be given a moment to do that."* (female, 41-45 years); *"It makes you relaxed if you have a permission to change."* (male, 26-30 years)

One participant envisioned a workspace that could be modified by pushing a button. He imagined to be able to change the appearance and atmosphere of the space very easily, including the visual appearance as well as the soundscape of the space. Also, another participant was talking about changing the mode of the space with different kind of music: *"The walls could be covered with display panels. As you push a button, you would be in Florida or somewhere else. My vision is a very much modifiable. One can change the wall from wood to ceramics... And if you push a button, it takes you into the jungle, and there would be a soundscape of the jungle. And up on a mountain there would be another soundscape."* (male, 26-30 years); *"One can change the mode of the space with music."* (female, 31-35 years)

Creativity, inspiration and innovation is often social in nature. The space of Liberty allows for being connected with people working in the same space (**Being part**). On the other hand, it is not isolated from the outer world either (**Connectedness**). A view for the hustle and bustle outside of the workspace, i.e. "bringing the outer world to the workspace" creates feelings of belonging. Connectedness to the outer world is provided in a discreet way that to maintain the concentration to the ongoing task: *"I would say that the space (for ideation) would exist a bit higher. In a way that one could see people down there.."* (male, 21-25 years)

4.2 Mindset 2: Fellowship

The second mindset is called *Fellowship*. Fellowship is a mindset *for sudden encounter and collaborative work*. In the space of Fellowship the atmosphere enables sudden encounter between people who might not necessarily meet otherwise (**Encounter**). The space prevents isolation and calls for meeting people and communicating with them (**Being part**): *“The space encourages to see and meet people in a comfortable way.”* (male, 21-25 years). The space is a place for co-operation between people (**Collaboration**). The space makes it possible for being close to other people (**Closeness**).

In addition to being part of the work community or other people in the space, there is also a need for being connected to the outer world (**Connectedness**). The atmosphere in this space is homely and relaxed (**Cosyness**) That is created with soft materials such as carpets, and the overall friendly and welcoming atmosphere: *“Yes, so that it would be homely, a little bit of soft material here and there.”* (male, 26-30 years); *“It makes you relaxed if there is homely atmosphere.”* (female, 31-35 years)

In the space of Fellowship, there are no hierarchies between people, and the titles and authorities are forgotten (**Equality**). The space mixes people from different levels and backgrounds, e.g., student, teachers, researchers and company workers. The space is defined by multidisciplinary approach and learning from others: *“Students see professors only in certain situation of authority, and vice versa. Meeting in other situations might generate new ideas.”* (male, 21-25 years)

4.3 Mindset 3: Determination

The mindset called *Determination* is *for focused, conventional work, which usually takes places in a group*. It is characterized by doing focused task completion (**Focus**). In the space for Determination people concentrate on specific task (**Concentration**). In addition, the work takes places in a conventional way (**Conventionality**) and deals with formal issues (**Formality**). There is no need for the space to provide additional inspiration or stimulation. The space offers ideal settings for sitting down, focused communication and making decisions: *“The strategy meeting of a company, for that a discreet atmosphere would do, restrained colors. People would be sitting. I would say that there one would not sit on beanbags in a relaxed way.”* (female, 41-45 years)

The atmosphere in the space for Determination enables the work in silent and peaceful settings (**Peacefulness**). The space is characterized with neutral colors and materials (**Discreetness**). The space keeps the work situation as a harmonized and focused experience: *“If one needs to talk about serious things, and for example decide something, I would say that it would not be very successful in a very colorful space.”* (female, 41-45 years); *“When one wants to keep focused and make decisions, then a colorless surrounding would do.”* (female, 50+ years)

The workspace is closed for the participating individuals and thus, it enables being connected (**Being part**) with relevant others. There is no need for connections to outer world, except maybe a video conference option for another worksite or a colleague who exists elsewhere. On the other hand, there is no reason why the space

for Determination could not include some beautiful elements (**Beauty**), such as nice curtain or some pieces of art, to provide aesthetic experience of in the middle of the focused work: *“It could be in a space which would have some arts, flowers, nice curtains and so forth.”* (female, 50+ years)

4.4 Mindset 4: Retreat

The fourth mindset is called *Retreat* and it is *for individual, concentrated work*. The Retreat provides personal space for the individual work when needed (**Independency**). Some work tasks, such as writing, require peaceful settings (**Peacefulness**) and a possibility to concentrate on specific task (**Concentration**): *“If one wants to read book, concentrate, or just be quiet, there could be own spot where to go.”* (female, 36-40 years). Sometimes people want to spend time with their own thoughts. For that purpose they need a space where they would feel safe (**Safety**): *“You would be safe (in that space), but not in an isolated cellar.”* (male, 26-30 years)

The Retreat enables selecting the distance to the others (**Selection**): *“In the group occasion, there could be small spaces where one could escape with one’s own thoughts. One could decide the distance to the rest of the group, to close oneself or be more open to others.”* (female, 26-30 years). Sometimes the work task or certain mood demand for a total isolation from the group. However, sometimes people need to work alone, but still having the feeling of not being in isolation (**Feeling connected**): *“One could just turn towards the forest - now you focus.”* (female, 26-30 years)

4.5 Mindset 5: Recovery

The fifth mindset discovered in this study is called *Recovery*. It is a mindset *for recreation during the break, either individually or collectively*. The space for Recovery aims at getting relaxed and “recharging batteries” (**Recreation**). It happens mostly through activities that are not direct work activities, but more more related to having a break. The space enables returning the mental balance (**Peace of mind**) after intensive work: *“To retreat and be quiet would be very good. One can sit, pray, meditate or whatever one wants to do.”* (male, 26-30 years). Especially in this space, people feel well and good (**Wellbeing**). It enables forgetting the demands and requirements of work for a while (**Escape**): *“A space to retreat from the normal hustle and bustle.”* (male, 26-30 years). The space also makes it possible to forget one’s physical surroundings for a while (**Captivation**): *“The space would disappear for a while and one could hear the relaxational soundscape, whatever it is. One could get the mind out of the thing that she has been concentrating for the whole day, for a short moment.”* (female, 41-45 years). In the space, one can feel safe (**Safety**). Recovery can happen in personal space or in a social setting.

In the space for Recovery, the workers are able to do their own things. On the other hand, it can be resting or meditation, but on the other hand it can be an active moment of including physical activity or stretching (**Activation**): *“I could go and have a walk in nature for 10 minutes.”* (female, 50+ years)

The wish and importance for being able to work in nature and outdoors, or in the settings that people of nature (**Nature experience**), is closely linked to the Recovery. The nature experience means either being in nature or bringing the elements of nature to the workspace, in form of materials, landscapes, soundscapes, fresh air and natural light: *“An indoor space where one can see a great view. A magnificent and big window.”* (female, 50+ years); *“I miss to be able to open a window, to hear sounds from nature, even the smallest blaster.”* (female, 41-45 years)

5 Concept Design of Ambiences for Pop Up Workspaces

In this section, we present the early phase examples of ambiances that were designed for the mindsets in a multidisciplinary concepting workshop. The ambiances were created as combinations of ambient technologies, space design and physical objects. Two of the ambiances are presented with example visualizations.

5.1 Ambience for Liberty

The space of Liberty (Fig. 1) can be best characterized with the following adjectives: rough, workshop-like, activating and modifiable. The appearance of the space is incomplete and raw, which gives workers freedom and courage to make modifications and test out things. The floor can be made of, for example, concrete, which gives an unfinished perception. It is possible to paint the space, for example paint the electronic wall paper with virtual colors. The space is spacious, i.e. there is plenty of space to do and modificate. There are also bright lights in the space.

The space and the furniture can be changed and molded by the workers. The material of the furniture is intelligent – it returns itself to the original shape by itself. There is a culture of being in courage in the space and not being limited by “the big brother”. The space provides plenty of different materials to be used, and removable walls to “construct the space” again and again. The space is like a testing platform where almost everything is possible to do. The modifications can stay in the space and the following users can see them as there is no need to reset the modifications after work.

Different viewpoints and stimulation are provided via a virtual window, which is a wall-sized display. From the virtual window, the workers are able to see wonderful still pictures or video from the metropolitan cities, their hustle and bustle and people coming and going. This reminds them of freedom, as in big cities there is a sense of freedom to be what you are. The soundscape that is created with 3D speakers matches with the view to the metropolis – the workers can hear a realistic hum of city: people talking, shoes knocking, cars driving and honking. The space smells like fresh air, and every now and then a refreshing breeze whisks through the space.

The space motivates to be on the move and work actively. The work is usually not done in the sitting mode, but by standing, moving, taking different positions and viewpoints. This is enabled with a dynamic floor. Like in the stage of a theater, the

floor rotates. The dynamic floor can be used as a treadmill, or as a source for dynamic thinking and taking different points of view.



Fig. 1. An example visualization of the ambience for Liberty.

5.2 Ambience for Fellowship

The space for Fellowship is an open space, visible from different directions. It is a space where sudden encounters take place, and where people are naturally located close to each other. The furniture is homely, and the atmosphere reminds of the living room. The lightning is warm and an electronic fire place brings cozy atmosphere. The space smells like coffee, bun and strawberry.

There are special, playful furniture in the space. The furniture discuss by sounds with each other, which may trigger conversation between the workers, too. In addition, as the user sits down on the chair, the chair makes noise. In the space, there are sympathetic animal robots that can be hugged.

The electronic board on the wall shows some information of the people who are in the space, which can trigger discussion. In the space, there is equipment for visualizing and writing the upcoming ideas collectively, for example on the drawing board that saves the outputs in a cloud service.

5.3 Ambience for Determination

The ambience for Determination can be described as “non-ambience”. It is a conventional space with neutral materials and minimal extra stimulus, meant for focused work. The appearance is almost ascetic, and the furniture is ergonomic for doing work in the sitting mode, but they also allows for adjusting the working position. The main focus in the space is in the focused task completion. The work happens discreetly and productively. The lightness of the space is like a natural light. A *pomodoro method* for working is in use (25 minutes of work and 5 minutes of break), and it is moderated via the loudspeakers of the space. During the break, the

space generates mild surprises, for example a prompt to stand up and make some stretching or simple gymnastic exercises.

The virtual window (display) of the space does not show any external stimulus, but it is meant for presenting factual information, e.g. task related information visualizations, charts, presentations, to do-lists, proceeding in the task, etc. As the ongoing task is completed, a tangible smart object on your desk cheers your completion in a discreet way.

5.4 Ambience for Retreat

The space for Retreat (Fig. 2) is surrounded by intelligent glass walls, whose transparency can be adjusted by the worker. The worker can set the walls as transparent when she or he wants to be closer to others and visible for them. By setting the walls as non-transparent the worker is able to achieve a total privacy. Also, different levels of semi-transparency are available depending on how “close” the user wants to be in relation to people around. The transparency of the space reveals worker’s availability for others – if they can see the user, she or he is more available than in the situations when the user has set the walls as non-transparent. This brings safety for the user, as she or he can be sure about not being disturbed by others. In the space of retreat there is a permission to be “offline”, i.e. not available for others.



Fig. 2. An example visualization of the ambience for Retreat.

In the space for Retreat, the atmosphere is cosy and peaceful, and it is created with a limited amount of space and height. The space reminds the user of a nest. The ambience in this space is personalized for the worker. Depending on the worker’s profile, the lightness of the space is adjusted. A personally meaningful landscape or object is visible on the virtual window. There can be a view for, e.g. a favorite nature place. Also the soundscape comes from the personal profile, i.e. user-defined music, sounds or silence is played.

5.5 Ambience for Recovery

The space for Recovery provides contrast for the work task that the worker has done lately. It is a space to escape the work demands. If the worker has conducted intensive, creative ideation in a group, she would most probably want to be alone for a while, in a peaceful and safe ambience. For those purposes, the space for Recovery adjusts the lightness as dark, and the worker can have a massage in a chair meant for that, or she can swing in the chair in prone position. The soundscape of the space is peaceful, either a total silence or peaceful music or sounds, for example noise of sea. The atmosphere is relaxing. On the ceiling of the space, a sky with stars is made of optical fibre. The space smells like fresh nature. The relaxational ambience is created in closed, safe space, which can be locked and which is not transparent for others.

On the other hand, if the worker has done concentrated work alone, she or he might most probably want to have an activating moment of Recovery with other people around. The social and active recovery might well take place in the space for Fellowship, by having a possibility to chat freely with others in a lively atmosphere. One possibility, which would offer contrast for focused work would be to take a short bike ride on a stationary bike, which would be located in front of a virtual window. From the window, the user could see a nice view to a cozy village, and she would feel as if she was biking in a village. The soundscape would match with the view.

6 Discussion and Conclusions

Ambient technologies which can be embedded in the space, for example screens and projectors, loudspeakers, sensors and small robots, provide novel possibilities for increasing the flexibility of the space, and the development of different ambiences for the future Pop Up workspaces. Knowledge work is an area that can benefit from the modifiability of the space, as the work practices are changing rapidly towards more collaborative, flexible and mobile (e.g., [1], [2]). Drawing on Gibson's concept of affordances [27], where the perceived properties of objects and environments allow or hinder certain actions or behavior relative to the individual, Pop Up spaces can be seen as affordances for experiences and ambiences supporting knowledge work. Allowing workers to adjust their work environment ambiences according to their tasks or preferences has a potential to increase their job satisfaction. Contextual individual flexibility is connected to organizational flexibility too, and "individuals' preconception, meanings, and views of that environment affect their behaviour" [10].

Through the experience-driven design process consisting of the participatory design study and a concepting workshop, we have resulted in a set of potentially meaningful experiences of future Pop Up workspaces, divided in five experience categories that we call mindsets. The set of experiences has similarities to as well as differences with the experiences listed in the PLEX model [16]. In addition, we have created initial concepts of workspace ambiences (or atmospheres) for the five mindsets. The ambiences were designed as versatile combinations of ambient technologies, real-world objects and space design. The presented ambiences have confluences with the concept of Digital Territory, which introduces the notions of

personal and public spaces, and the blurring boundaries between those, in the Ambient Intelligence environment [28]. Our future vision is that the workers the workspace could modify the workspace by selecting the ambience of the space according to their work task, mood, etc. The ambiances would increase the flexibility of the space, thus supporting the productivity and wellbeing of the workers.

As our research consists of qualitative methods and thus, limited amount of data sources (participants), the validity and generalisability of the results are limited. However, this early-phase research aimed to be explorative and generative rather than reveal statistically proved facts. We will continue our work by validating the meaningful experiences for future Pop Up workspaces, as well as testing the future possibilities and limitations of our concepts of workspace ambiances. We will also test different possibilities of ambient technologies to construct the Pop Up workspaces described in this paper.

References

1. Coenen, M., Kok, R.A.: Workplace flexibility and new product development performance: The role of telework and flexible work schedules. *European Management Journal*, 32(4), 564-576 (2014)
2. Waber, B., Magnolfi, J., Lindsay, G.: Workspaces that move people. *Harvard business review*, 92(10), 68-77 (2014)
3. Dantzig, S., Geleijnse, G., Halteren, A.T.: Toward a persuasive mobile application to reduce sedentary behavior. *Personal and Ubiquitous Computing*, 17 (6), 1237-1246 (2013)
4. Poutanen, J.: Pop-Up Spaces: From Prototyping to a Method of Revealing User-Attitudes. In: Chudoba, M., Joachimiak, M., Laak, M., Lehtovuori, P., Partanen, J., Rantanen, A., Siter, N. (eds.) *ATUT Proceedings, 5th Annual Symposium of Architectural Research, ARCHITECTURE AND RESILIENCE*, pp. 13-23 (2013)
5. Vartiainen, M.: Hindrances and enablers of fluent actions in knowledge work. In: Sachse, P., Ulich, E. (eds.) *Psychologie menschlichen Handelns: Wissen und Denken – Wollen und Tun*, Pabst Science Publishers, pp. 95-111 (2014)
6. Desmet, P., Schifferstein, R.: (eds.) *A Collection of 35 Experience-Driven Design Projects*. Eleven international publishing (2012)
7. Logan, R. J., Augaitis, S., Renk, T.: Design of simplified television remote controls: A case for behavioral and emotional usability. *Proceedings of the 38th Human Factors and Ergonomics Society Annual Meeting*, Human Factors and Ergonomics Society, 38(5), 365-369 (1994)
8. McIver, D., Lengnick-Hall, C., Lengnick-Hall, M., Ramachandran, I.: Understanding work and knowledge management from a knowledge-in-practice perspective. *Academy of Management Review*, 38(4), 587-620 (2013)
9. Appel-Meulenbroek, R., Groenen, P., Janssen, I.: An end-user's perspective on activity-based office concepts. *Journal of Corporate Real Estate*, 13(2), 122-135. Emerald Group Publishing Limited (2011)
10. Värlander, S.: Individual Flexibility in the Workplace: A Spatial Perspective. *The Journal of Applied Behavioral Science*, 48(1), 33-61. Sage (2012)
11. Peponis, J., Bafna, S., Bajaj R., Bromberg, J., Congdon, C., Rashid, M., Warmels, S., Zhang, Y., Zimring, C.: *Designing Space to Support Knowledge Work*. Environment and Behavior, 39(6), 815-840. Sage Publications (2007)
12. Hassenzahl, M.: Hedonic, emotional, and experiential perspectives on product quality. In: Ghaoui, C. (Ed.) *Encyclopedia of human computer interaction*, 266-272. Hershey, PA, USA: Idea Group Reference (2006)

13. Hassenzahl, M.: The thing and I: Understanding the relationship between user and product. In: Blythe, M.A., Overbeeke, K., Monk, A.F., Wright P.C. (Eds.) *Funology, from usability to enjoyment* (pp. 31–42). Norwell, MA, USA: Kluwer Academic Publishers (2003)
14. Olsson, T., Väänänen-Vainio-Mattila, K., Saari, T., Lucero, A. and Arrasvuori, J.: Reflections on experience-driven design: a case study on designing for playful experiences. *Proceedings of the 6th International Conference on Designing Pleasurable Products and Interfaces*, 165-174 (2013)
15. Hassenzahl, M.: *Experience Design, Technology for All the Right Reasons*. Morgan & Claypool, (2010)
16. Arrasvuori, J., Boberg, M., Holopainen, J., Korhonen, H., Lucero, A., Montola, M.: Applying the PLEX framework in designing for playfulness. *Proceedings of the 2011 Conference on Designing Pleasurable Products and Interfaces (DPPI '11)*. Article 24, 8 pages (2011)
17. Norberg-Schulz, C. *Genius Loci -- Towards a Phenomenology of Architecture*. Rizzoli International Publications, New York (1980)
18. Karjalainen, T-M., Koskinen, J., Repokari L.: *Ambience Design: Creating Multi-Sensory Moods within Built Environments*. Conference presentation at HAAMAHA (2005)
19. Koskinen, J.: *Ambience Design Notes*. *Service Design: On the Evolution of Design Expertise*. Lahti University of Applied Sciences Series A, Research reports, part, 16, 155-165 (2012)
20. Wisneski, C., Ishii, H., Dahley, A., Gorbet, M., Brave, S., Ullmer, B., Yarin, P.: *Ambient Displays: Turning Architectural Space Into an Interface between People and Digital Information*. In: *Cooperative Buildings: Integrating Information, Organization, and Architecture*. *Lecture Notes in Computer Science*, Volume 1370, pp 22-32. SpringerLink (1998)
21. Wang, J., Mughal, M.A.: *LiveNature: connecting people with their cherished places*. *Proceedings of the companion publication on Designing interactive systems* , 113-116 (2014)
22. Cao, Y.Y., Okude, N.: *Scented Pebbles: Interactive Ambient Experience with Smell and Lighting*. *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction (TEI '15)*. 409-410 (2015)
23. Ip, H.H., Kwong, B.: *Smart ambience games for children with learning difficulties*. *Technologies for E-Learning and Digital Entertainment*. 484-493, Springer Berlin-Heidelberg (2006)
24. Kuijsters, A., Redi, J., de Ruyter, B., Seuntjens, P., Heynderickx, I.: *Affective ambiances created with lighting for older people*. *Lighting Research and Technology* (2014)
25. Wright, P., McCarthy, J.: *Experience-Centered Design - Designers, Users, and Communities in Dialogue*. Morgan and Claypool (2010)
26. Zhang, Y., Wildemuth, B.M.: *Qualitative analysis of content. Applications of social research methods to questions in information and library science*, 308-319 (2009)
27. Gibson, J.J.: *The ecological approach to visual perception*. Boston, MA: Houghton Mifflin (1979)
28. Daskala, B., Maghiros, I.: *Digital territories*. *IET International Conference on Intelligent Environments*, vol.2, 221-226 (2006)

Picture sources:

Fig. 1: Room: http://pixabay.com/p-597166/?no_redirect; Display: http://pixabay.com/p-160135/?no_redirect; Light bulbs: <http://www.jisc.ac.uk/td/get-involved/research-data-spring>; People sitting: http://pixabay.com/p-703002/?no_redirect; Beanbag chairs: http://pixabay.com/p-21493/?no_redirect; Melody: http://pixabay.com/p-148443/?no_redirect; People walking: http://pixabay.com/p-609640/?no_redirect; Man painting graffiti: © Bogdan / Wikimedia Commons / CC-BY-SA-3.0 / GFDL <http://commons.wikimedia.org/wiki/File:Graffiti-Bucharest.jpg>; Man sitting in a beanbag chair: © Dave Morris / CC-BY-2.0 <https://www.flickr.com/photos/12771303@N00/4455307/>; City: © Adam J.W.C. / CC-BY-SA-2.5 http://commons.wikimedia.org/wiki/File:City_of_sydney_from_the_balmmain_wharf_dusk_cropped2.jpg; Street artist: © K. C. Tang / CC-BY-SA-3.0 / GFDL http://commons.wikimedia.org/wiki/File:Street_artist_Centre_Pompidou.jpg
Fig. 2: Glass cube: © Hubert Berberich / CC-BY-3.0 http://commons.wikimedia.org/wiki/File:Glass_Cube_Mannheim_night.jpg; Office: © Foundation7 / CC-BY-SA-3.0 http://commons.wikimedia.org/wiki/File:The_Park_Northpoint_-_Open_Plan_Office_Space.jpg; Rain water dripping: © Horia Varlan <https://www.flickr.com/photos/horiavarlan/4303835161/in/gallery-dentonpotter-72157635510954827/>; Working by the beach: © Yuvi Panda / CC-BY-3.0 http://commons.wikimedia.org/wiki/File:Yuvi_working_on_beach_1.jpg; Glass texture: <http://pixabay.com/en/glass-texture-window-reflection-163865/>
Full licence details: GFDL (GNU Free Documentation License): http://en.wikipedia.org/wiki/Wikipedia:Text_of_the_GNU_Free_Documentation_License; CC-BY-SA-3.0: <http://creativecommons.org/licenses/by-sa/3.0/>; CC-BY-SA-2.5 <http://creativecommons.org/licenses/by-sa/2.5/deed.en>; CC-BY-2.0: <http://commons.wikimedia.org/wiki/Category:CC-BY-2.0>; CC-BY-3.0: <http://creativecommons.org/licenses/by/3.0/deed.en>; Pixabay: http://pixabay.com/en/service/terms/#download_terms