

THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

User experiences with flexible offices

Antonio Cobaleda-Cordero



Department of Industrial and Materials Science

Division Design & Human Factors

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Abstract

Different office types provide the preconditions for distinct user experiences. However, research evidence on how users appraise flexible offices such as activity-based or combi offices is not as abundant as in the case of the more traditional open-plan and cell offices. Furthermore, the available literature shows discrepant results between flexible offices. The main difference between traditional and flexible offices is that the design of the latter is intended for users to switch between different shared spaces and workstations oriented to support different activities, needs and preferences. This office design may offer new opportunities and challenges for users as their experiences at work may be influenced by design qualities (or constellations of them) that are not present in traditional offices. I study the experiences of users with flexible offices because I want to understand the influences that the design qualities of office artefacts and spaces have on such experiences, as well as their design implications. In addition, I utilise the acquired knowledge to explore design opportunities for positive user experiences with flexible offices. In this regard, the research angle adopted builds on a UX theoretical background and a practical approach with multiple user studies in real office environments.

The findings show that user experiences with flexible offices are influenced by interrelated design qualities of the spaces and artefacts in use, rather than isolated qualities. These (tangible and intangible) qualities define the nature of an artefact, a space, or constellations of them that users experience, for instance the qualities of an office chair vs. a meeting room. Experiences are subjective, but relate to both individual and collective experiences, for example using an ergonomic workstation vs. sharing such workstations. The findings also suggest that designing for user experiences with flexible offices is a highly complex endeavour, and that emphasis should be placed on designing for the experiences of pleasure, community, autonomy, purpose, and control over the environment.

Utilising this knowledge to develop and test research prototypes allowed for a richer understanding of the experiential process and its relation to more systemic aspects such as the context of use or the temporality of experiences. Derived from these research activities and their findings, I present in this thesis the tentative SEEX (Stimuli-Evaluation-EXperiential outcome) model of how user experiences take place. This thesis contributes knowledge on theoretical and practical levels for academics and practitioners to continue studying office user experiences from a UX perspective, support informed decisions in the planning, operation, and evaluation of offices, and explore design opportunities for office environments.

Keywords: user studies; user experience; UX; design qualities; office design; combi office; activity-based flexible office; design research.

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Appended publications

Publication A

Cobaleda Cordero, A., Babapour, M. and Karlsson M. (2019). *Feel well and do well at work. A post-relocation study on the relationships between employee well-being and office landscape*. Journal of Corporate Real Estate, <https://doi.org/10.1108/JCRE-01-2019-0002>

Cobaleda-Cordero planned and designed the study, collected, and analysed the data, and wrote the publication. Babapour contributed to the analysis and the writing. Babapour and Karlsson provided feedback on the study design and the publication.

Publication B

Cobaleda-Cordero, A., Babapour, M., & Karlsson, M. A. (2020). *Flexible office, flexible working? A post-relocation study on how and why university employees use a combi-office for their activities at hand*. International Journal of Human Factors and Ergonomics, 7(1), 26–54. <https://doi.org/10.1504/IJHFE.2020.107286>

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Forooraghi, M., Cobaleda-Cordero, A. and Babapour, M. (2021) *A healthy office and healthy employees: a longitudinal case study with a salutogenic perspective in the context of the physical office environment*. Building Research and Information, 0(0), 1–18. <https://doi.org/10.1080/09613218.2021.1983753>

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Publication D

Cobaleda-Cordero, A., Babapour, M., & Karlsson, M. A. (Submitted to Applied Ergonomics and accepted with major revisions). *User experiences with the spaces and artefacts of a flexible office – A post-relocation case study*.

Cobaleda-Cordero contributed to the planning and design of the study, the data collection, the analysis, and wrote the publication. Babapour led the study design and planning, and contributed to the data collection, analysis, and writing. Babapour and Karlsson provided feedback on the study and the publication.

Publication E

Cobaleda-Cordero, A., Babapour, M., & Karlsson, M. A. (Submitted to Co-Design). *Exploring design opportunities for positive UX with flexible offices – Bridging research & practice.*

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Publication F

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Cobaleda-Cordero planned and designed the study, collected, and analysed the data, and wrote the publication. Babapour and Karlsson provided feedback on the study and the publication.

Publication G

Babapour, M. and Cobaleda-Cordero, A. (2021). *Methods for eliciting user experience insights in workplace studies: spatial walkthroughs, experience curve mapping and card sorting* *User experience insights in workplace studies.* Journal of Corporate Real Estate, 2021. <https://doi.org/10.1108/JCRE-12-2020-0069>

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Additional publications

Related to this thesis and topic but not appended:

Cobaleda Cordero, A., Rahe, U., Wallbaum, H., Jin, Q. and Forooraghi, M. (2017). *Smart and Sustainable Offices (SSO): Showcasing a holistic approach to realise the next generation offices*. Informes de la Construcción, 69(548): e221, doi: <http://dx.doi.org/10.3989/id.55278>

Cobaleda Cordero, A. and Babapour, M. (2017). *Discrepancies between intended and actual use in Activity-based Flexible Offices - A literature review*. NES 2017. Joy at work. 20-23 August 2017. Lund University, Lund. Sweden.

Babapour, M., & Cobaleda-Cordero, A. (2020). *Contextual user research methods for eliciting user experience insights in workplace studies*. In Transdisciplinary Workplace Research Conference (pp. 1–10).

Babapour, M., Cobaleda-Cordero, A., & Karlsson, M. (2021). *ACTIVITY THEORY A framework for understanding the interrelations between users and workplace design*. In R. Appel-Meulenbroek & V. Danivska (Eds.), *A handbook of theories on designing alignment between people and the office environment* (pp. 236–247). Routledge. <https://doi.org/10.1201/9781003128830-20>

Cobaleda-Cordero, A. and Babapour, M. (2021). *Design for UX in Flexible Offices – Bringing Research and Practice Together*. Proceedings of the 21st Congress of the International Ergonomics Association (IEA 2021). Volume 5: methods & approaches (ISBN 978-3-030-74613-1). 13-18 June 2021. Vancouver. Canada.

Glossary

Design quality: a tangible or intangible design property that defines the apparent nature of something (used for office spaces and artefacts in this thesis) and has a pragmatic, hedonic, symbolic, emotional, and/or social value.

Experience: it can refer to (i) knowledge accrued, or ability acquired with the observation or the participation in an event(s) over time; or (ii) a life event that influences one's physical or psychological state

Flexible office: an office type designed with a variety of shared settings oriented to support diverse activities requiring different levels of concentration and interaction, for example, active and semi-quiet open zones with workstations for solitary and collaborative work, quiet rooms for focused solitary work, open meeting spaces and rooms of different sizes, teleconferencing rooms, phone booths, spaces for breaks, lounge seats, etc. Workstations can be shared or assigned to individuals or work units.

Office artefact: physical human-made object whose design and function(s) were deliberately conceived for its use in office environments.

Office space: physical built environment, often indoors, whose design and function(s) were deliberately conceived for knowledge work activities.

System: in this thesis refers to artefacts, spaces, services, or a constellation of these. Therefore, an office chair can be understood as a system consisting of a number of subsystems (components); an entire office can be understood as a (complex) system too, consisting of technical subsystems such as artefacts and spaces, and social subsystems with humans.

Traditional office: in this thesis refers to those office types designed before flexible offices, mainly consisting of open-plan or (individual/shared) rooms, where users conduct most of their work activities by an assigned workstation.

Use: a general term referring to the action of interacting with a system, such as an office artefact, a space or a constellation of them to fulfil a purpose.

User: the person who uses something.

User experience: experience derived from the anticipated, perceived or remembered use of a system in a context, which can result in affective, expressive, physiological and/or behavioural responses, as well as a learning for the subject(s) of the experience. It refers to the subjective dimension of using something, hence, it has a narrower scope than experiences in general.

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1. Introduction

This thesis is framed in the extensive research field that focuses on the interrelations between office designs and their users, the extent to which these offices enable users to thrive, their motives and concerns to use, underuse, or misuse their offices, and their insights on what a good office should be.

1.1. The path to flexible office environments

One of the first European examples of the modern office building was the Uffizi in Florence built in the 1560s. In that building, all the public offices, guilds, archives, and court artists were centralised for better efficiency, public accessibility, and supervision by the government of the time (Dennis, 1980). Other official spaces (such as palaces and houses) became too small for the growing trading operations and governmental work that accompanied the end of the Middle Ages and the beginning of the Modern Age.

A few centuries later, the Industrial Revolution increased the need for white-collar workers handling the administration and logistics of the mass production of goods (van Meel, 2000, pp.25-26). The offices of this time were separate halls on factory floors. Towards the end of the 19th century and the beginning of the 20th, innovations in construction materials, the invention of the elevator, and the telegraph allowed offices to emerge as a new typology of building in cities. The layout of offices both on factory floors and in cities was inspired by the Taylorist conception of factories where work was broken down into smaller standardised tasks in the search for maximum efficiency, with workers sitting in rows of desks facing the same direction for better surveillance (van Meel, 2000, p.27).

During the first half of the 20th century, improvements in the buildings' infrastructure enabled a uniform distribution of lighting and energy (and longer workdays), deeper building floorplans, and comfort conditions that could be

achieved independently from natural lighting, ventilation, or outdoor climate (Lovell, n.d.). These offices were still open-plan spaces for clerical workers with managers sitting in separate office rooms. Around the 1950s, organisational changes originated the cluster of individual workstations into task-based groups.

In the 1960s the German concept of 'bürolandschaft' brought the democratisation of workplaces and promotion of flexibility and communication. Workstations were no longer necessarily distributed in rectangular grids and spatial dividers such as greenery could be adapted to changing organisational needs. This office model buried the Tayloristic open-plan office but faded away within a decade in favour of cellular offices in some countries (van Meel, 2000, p.50) and updated versions of traditional open-plan offices in others (van Meel, 2000, pp.33-37).

In the mid-'60s, Robert Propst designed the concept of 'Action Office' for furniture manufacturer Herman Miller that was an alternative to open-plan and bürolandschaft. It was a modular furniture system configurable according to different tasks (Propst, 1966). However, this idea was soon adapted to a cheaper (and ill-reputed) concept: the office cubicle (Saval, 2014). Cubicles became particularly popular in the USA, where the focus on economic efficiency continued through to the '70s and even '90s. When technology allowed for remote working, companies such as IBM started to experiment with that idea to further reduce costs (Sroka, 2018). However, organisations have limited or reversed this practice over time, as employees seem more productive, creative, and innovative when working together (ibid).

The '90s and '00s saw the emergence of workplaces designed to promote not only productivity and efficiency but also creativity and well-being (de Klerk, 2014). Greener buildings both in terms of energy efficiency and biophilic design attracted increased interest. New office buildings had a wider variety of spaces and in-house services such as restaurants, gyms, kindergartens and so on. In the case of extremely wealthy companies such as Google, offices became more like campuses or mini-cities where workers had everything they needed (Bort, 2013).

During the '80s and '90s, new attempts at office innovations similar to the action office paved the ground for the emergence in the '90s of flexible offices as we know them today (Appel-Meulenbroek *et al.*, 2011; van der Voordt, 2004a). These offices have different settings for individual activities requiring different levels of concentration, group work, social interaction and so on, so that employees can choose the setting that best fits their needs, preferences, and activity at hand, or even work from home (Bodin Danielsson, 2016; Wohlers and Hertel, 2016). In this case, the relationships between managers and employees are based on trust, as employees are no longer under surveillance.

There are different types of flexible offices, such as activity-based offices or activity-based flexible offices, where organisations often dimension offices for about 70% of the staff, assuming that desks will be shared because not everyone will need a desk at the same time (Bodin Danielsson, 2016). This helps make room for other types of spaces or simply reduces the size and cost of the premises (Kim *et al.*, 2016). Here, employees usually have a locker to store belongings and are encouraged to work paperless. Another type of flexible office design is the combi office where users have both assigned workstations and back-up spaces for other activities (Bodin Danielsson, 2016). Current combi offices refer to an evolved version of the original term coined in Sweden in the '70s in relation to offices with cell rooms grouped around an open space intended for meetings and the use of common facilities (van Meel, 2000, p.99). Today, combi offices have no strict spatial definition and, apart from the assigned workstations, share numerous features with activity-based offices.

Other designs that could also be labelled as flexible are co-working and desk-hoteling. However, in these cases, the flexibility often relates to the possibility to pay for workstations on an as-needed basis, rather than to the variety of spaces.

1.2. Flexible office designs

Offices such as open-plan and cell offices have been studied for decades. They represent the most traditional office designs, and the abundant research evidence about them seems to show consensus on how these are perceived. For example, open-plan offices are associated with lower job satisfaction, more noise, and lack of privacy (Bodin Danielsson and Bodin, 2009; de Croon *et al.*, 2005; Kim and de Dear, 2013) with consequences for users' well-being and perceived performance (Haapakangas *et al.*, 2018). In the case of cell offices, users tend for example to report higher satisfaction with privacy and better health (Bodin Danielsson and Bodin, 2008), but also more difficulties in interacting with colleagues (Kim and de Dear, 2013).

The more recent flexible offices represent a paradigmatic change compared to previous, more traditional offices. For example, they clearly differ in the (intended) use that users make of them by sharing different settings optimised for different activities (Appel-Meulenbroek *et al.*, 2011). The shared quality of spaces and artefacts also entails specific rules for use of the office, such as clean-desk policies (Babapour and Rolfö, 2019). Users in flexible offices use a constellation of their personal artefacts with those shared (if available), that are often assigned (not shared) in traditional offices. This can be seen either as an extra burden due to changing constellations or as an opportunity to manage resources and adapt on-demand. Further, these offices often have open spaces, for example for workstations in an interactive zone, but there is no strict definition of their design

qualities¹ on an architectural level (Bodin Danielsson, 2016). In theory, the flexibility to choose where and when to work should contribute to avoiding some of the issues that users of traditional offices experience such as the lack of privacy or communication trade-offs. However, when users switch workstations and spaces, they also need to carry belongings, adjust workstations before use, or condition the choice of a place to sit near colleagues (Marzban *et al.*, 2022), as they may sit in different places within and outside the premises on a regular basis. Therefore, the design qualities of spaces and artefacts in flexible offices imply opportunities and challenges for users that are not present in traditional offices.

1.3. Knowledge gaps in the study of flexible offices

The reviews by Engelen *et al.* (2019) and Marzban *et al.* (2022) provide an overview of the findings from previous studies on flexible offices. Nonetheless, the available literature is not as prolific as in the case of traditional offices due to the relatively recent popularisation of this office type. At least three knowledge areas have been identified that call for further research.

Discrepant results

The growing body of research shows discrepant results and suggests that users' perceptions of their flexible offices are rather case-specific. For example, Brunia *et al.* (2016) identified remarkable differences in users' satisfaction with flexible offices (over 50%) that are explained to a notable extent by the support of the physical environment, the implementation process, and organisational management, among other factors. Hoendervanger *et al.* (2016) suggest that flexible offices fit some work profiles (e.g., high interactivity, mobility, and task variety) better than others, and this partly explains differences in user satisfaction. Rolfö (2018) indicates that satisfaction with the flexible office concept also varies, for example, in relation to the office type before a relocation or the need for concentration.

Results concerning users' habits of switching workstations also vary notably. For example, Häne and Windlinger (2021) report that up to 70% of users surveyed switched workstations once or more a day, and Meijer *et al.* (2009) report that 86% of the office users switched workstations regularly. Conversely, Qu *et al.* (2010) report that 70% of users consistently chose the same workstations and 20% of those who switched workstations chose the same or adjacent areas. Further, de Been *et al.* (2015) identified territorial behaviours in 11 out of 20 cases studies that

¹ In this thesis, the term 'design quality' is used to refer to a tangible or intangible design property that defines the apparent nature of something (office spaces and artefacts in this case) and has a pragmatic, hedonic, symbolic, emotional, and/or social value.

related to workstations being claimed for repeated use or with personal belongings. Appel-Meulenbroek *et al.* (2011) and Tagliaro and Ciaramella (2016) also reported 25%-35% of the desks being affected by territorial behaviours.

Regarding privacy, some studies report unwanted visual exposure, or difficulties in having conversations with nearby colleagues and talking on the phone without being heard or hearing others (e.g., de Been *et al.*, 2015; Gorgievski *et al.*, 2010; Pullen, 2014). Furthermore, Hoendervanger (2021, p.8) reported in his thesis that open spaces are recurrent in flexible offices and relate to perceptions of lack of privacy for high-concentration work. On the other hand, Bodin Danielsson and Bodin (2009) found positive results in relation to the possibility of avoiding being observed by choosing different workplaces, and Blok *et al.* (2009) report a positive impact on privacy after the implementation of the flexible office. Pullen (2014) notes that perceptions of privacy also vary with age, seniors being more sensitive to the lack of privacy.

Concerning health-related aspects, studies such as Foley *et al.* (2016) and Meijer *et al.* (2009) report reductions in sedentary habits and increases in general health respectively, while other studies such as Vink *et al.* (2012) and Seddigh *et al.* (2014) do not find significant differences between traditional and flexible offices. Nevertheless, studies evaluating the influence of office design on users' health and well-being are limited and often pay more attention to the negative influences than to the positive influences (see reviews by Groen *et al.*, 2018; Jensen and van der Voordt, 2019).

These discrepancies could be partly attributed to the contextual differences inherent in every case, even between traditional offices. However, these differences are also consistent with the no-strict spatial definition of flexible offices mentioned above. In other words, it seems more likely that the constellation of design qualities of two flexible office designs will differ more between cases than in traditional offices and, consequently, provide the preconditions for distinct experiences. Hence, these discrepancies taken together suggest the need for a deeper understanding of the qualities that influence how users perceive and use their flexible offices.

User experiences that are not studied from a user experience (UX) angle

The study of how users perceive and use their offices has been approached from multiple angles. For example, the study by Appel-Meulenbroek *et al.* (2015) is a contribution in the field of facility management that reports on a number of facility, design, and user variables with the potential to predict the use of flexible offices. Also in the field of facility management, Maarleveld *et al.* (2009) propose

a toolkit to measure space utilisation and satisfaction with a comprehensive list of variables for office evaluations and benchmarking purposes. Haapakangas *et al.* (2018) elaborate on factors influencing users' perception of stress with open-plan office designs from an environmental psychology standpoint. Coelho *et al.* (2015) draw on ergonomics to investigate the associations between users' work conditions and musculoskeletal issues. Sakellaris *et al.* (2019) adopt an engineering approach to study users' personal control over indoor environmental variables such as noise, privacy, temperature and lighting. Göçer *et al.* (2019) present a study in the field of architecture that focuses on users' satisfaction with various environmental factors such as office aesthetics, privacy, noise, and thermal comfort predicting perceived productivity.

These studies have often focused on unveiling cause-effect correlations between the design qualities of office environments and variables such as satisfaction, perceived productivity and ill-health symptoms (e.g., Göçer *et al.*, 2019; Haapakangas, Hallman, *et al.*, 2018; Lamb and Kwok, 2016). Gaining higher awareness of such correlations is a relevant contribution for these studies to consider with regard to office planning and operation. Nevertheless, knowledge of the experiences that the users undergo with their offices while at work is often limited or disregarded.

Fewer studies focus on experiences with a more qualitative approach that contribute to a deeper understanding of how office users perceive and use their offices (e.g., Alexander, 2010; Babapour, 2019). These studies also rely on diverse disciplines and theoretical approaches. For example, Alexander (2010) studies and proposes tools for the study of offices from a usability perspective, while Babapour (2019) studies flexible offices from the perspectives of Activity Theory, Artefact Ecology, and appropriation of technological innovation. In the Nordic European context, there is also a long tradition of human-centric, collaborative, and participative (decision-making) processes in workplace development that further contribute to explaining the larger contextual landscape in which office-related experiences take place (Broberg *et al.*, 2010; Nenonen and Lindahl, 2017). Overall, the diversity of disciplines, theoretical perspectives, and research approaches adopted in office studies is further embodied in the proceedings of the first two Transdisciplinary Workplace Research Conferences (Kämpf-dern and Will-zocholl, 2020; Nenonen *et al.*, 2018), and the book 'A Handbook of Theories on Designing Alignment between People and the Office Environment' by Appel-Meulenbroek and Danivska (2021).

However, these studies address the experiences of users as a peripheral matter rather than as a phenomenon with its own research entity; the focus is on concrete aspects or variables of office-user interactions that vary according to the discipline

to which they belong and the theoretical underpinnings of their respective fields. User experiences involve more than satisfaction rates alone, more than usability matters alone, or more than perceived ill-health symptoms alone. User experiences as a whole involve subjective perceptions and assessments, emotions, motivations, and actions in relation to tangible and intangible stimuli in a situated and dynamic context (Hassenzahl, 2011; Roto *et al.*, 2011). In this regard, it is the field of user experience (UX) that addresses the user experiences derived from using ‘things’ as a phenomenon of study. Having said that, (and despite the diversity of office user studies) literature explicitly addressing experiences with offices from a user experience (UX) perspective is infrequent, regardless of the office type.

The review by Pettersson *et al.* (2018) states that UX studies mostly focus on digital products and services such as apps, interactive games or websites, and emphasise that UX with multi-touchpoint/devices and multi-user environments are addressed by a striking minority of studies across disciplines. However, flexible offices are multi-touchpoint and multi-user environments, so there is value in studying in greater detail the influences that flexible office designs have on the experiences of users from a UX perspective.

In this thesis, the study of user experiences with flexible offices is approached from a UX angle (see Chapter 2), meaning that the above-mentioned literature on office studies also contributes to the positioning of my research in a relatively novel research niche. Thus, the study of office UX contributes to expanding the literature on office user studies, and UX literature with studies addressing experiences with multiple physical artefacts in multi-user environments.

Action is needed too

The reviews by Clements-Croome (2015), Colenberg *et al.* (2020), and Jensen and van der Voordt (2019) address many of the office-user interrelations introduced in the previous paragraphs and underscore that the design qualities of physical office environments influence users’ perceptions and use of offices. In the case of flexible offices, the study of the influences in relation to their design qualities and implications is more recent, but the growing body of literature contributes relevant knowledge (Babapour, 2019; Rolfö *et al.*, 2019). For example, Babapour (2019, p.106) reports the occurrence of negative experiences in flexible offices due to suboptimal design qualities of shared artefacts and spaces that make these harder to use, unpleasant, unreliable, or even unavailable. Hence, there is some knowledge that could and should be utilised to act upon, improve experiences with offices, and change what needs to be changed.

Gray *et al.* (2015) distinguish between two approaches to connect research to action: ‘evidence-based practice’ and ‘knowledge production/utilisation’. In this

sense, practitioners, policy makers and planners align better with evidence-based practice as decisions are (or should be) based on scientific evidence, criteria, or guidelines. An example of this could be the European Commission and its Joint Research Centre (JRC European Commission, 2011). The other knowledge production/utilisation approach attempts to bring together knowledge producers and users through processes that are interactive and dynamic, rather than technical and concrete (Gray *et al.*, 2015). The latter resembles more the problem-solving character of design engineering and design thinking approaches (Dell’Era *et al.*, 2020).

From my design background, knowledge facilitates action through informed decisions, and it is also essential to devise strategies for and explore what is yet to be known, for example, explore new design opportunities from a user-centred perspective. The utilisation of research knowledge has been long discussed as necessary for research to have an actual positive impact on society (Cain and Allan, 2017). Public institutions and funding strategies also acknowledge the value of research utilisation as an economic driving force (Gunn and Mintrom, 2016). Ion *et al.* (2019) point out that the dissemination and utilisation of research are interconnected activities, but that dissemination is not enough to ensure that research will be utilised. Rogers (2003, pp.8-12) exemplifies how communication in the diffusion of innovation does not necessarily imply its adoption, even when the innovation has evident advantages (cf. the QWERTY keyboard designed to prevent jams in old typewriting machines by slowing down typewriters vs. the more efficient design of the Dvorak keyboard that could be used today). This suggests that researchers should take the initiative more often to utilise their acquired knowledge, for example, in collaboration with practitioners for real-world applications, or to further advance learning by putting knowledge into practice. Accordingly, this thesis is devoted to the acquisition of knowledge about user experiences with flexible offices as well as its utilisation.

What I propose and try in this thesis is to utilise available and acquired knowledge to bridge the gap between research and action discussed in Gray *et al.*, (2015), through the exploration of design opportunities for positive user experiences with flexible offices. The purpose would not be to follow an implementation process for the sake of providing a market-ready solution to a problem; instead, I propose knowledge utilisation as a means to gain a more in-depth understanding of users’ experiential processes and the preconditions to be designed for positive experiences to occur.

1.4. Aim & research questions

This thesis focuses on the study of the experiences of users working in flexible offices. The aim is threefold: (i) firstly, to gain a richer understanding of the influences that the design qualities of flexible offices have on the user experience,

- **Research question 1.** What design qualities of spaces and artefacts in flexible offices influence the user experience? How?

Secondly, (ii) to gain an understanding of the design implications of such influences for user experience with flexible offices,

- **Research question 2.** What design implications are there to consider for improving the user experience with flexible offices?

And, finally, (iii) to utilise the knowledge acquired to gain further insights on how these office spaces and artefacts are experienced and could be (re)designed for positive user experiences with flexible office environments.

- **Research question 3.** How (if possible) can one design for positive user experiences with flexible offices?

1.5. Scope & significance

My research has an overall hands-on character, meaning that I do not have the purpose of engaging in theoretical debates underlying the study of offices. Office-related and UX literature has been reviewed, contrasted, and compared in my research to be able to take an informed standpoint about the UX construct, how to study UX in the office context, and how to meaningfully contribute to both fields of literature. Further, the thesis as a whole is intended to assist decision-makers with empirical evidence for the planning and operation of offices, as well as the development of meaningful office artefacts and spaces.

The rationale of my research is supported by the impact that office design has on users' well-being at work, and the impact of this well-being on business costs (van der Voordt and Jensen, 2021). In this respect, staff represents about 90% of operating costs (Alker *et al.*, 2014), implying that even small improvements in how users experience their offices can have significant financial implications. In addition, suboptimal office experiences will result in users adopting coping behaviours to protect their own well-being, which can cause important differences in energy consumption and the carbon footprint of office buildings (Hong and Lin, 2013). In this regard, design has an important role in how humans relate to their surroundings and it can actively contribute to the well-being of individuals (Desmet and Pohlmeier, 2013).

1.6. Thesis outline

The remainder of the thesis is structured in six additional chapters: Chapter 2 introduces the theoretical background for the thesis and clarifies the thesis stance on UX; Chapter 3 provides an overview of my research approach and the research activities conducted during my doctoral studies that have been included in this thesis; Chapter 4 compiles and summarises the findings of my research to answer each of the three research questions; Chapter 5 proposes the tentative SEEX model for the study and understanding of UX with offices, as a theoretical development derived from my research activities; Chapter 6 discusses the main findings, the research and theoretical approaches, the proposed model, and the implications of the research conducted; and finally, Chapter 7 provides a summary of the contributions of this thesis. The seven journal publications upon which this thesis builds are appended at the end of the manuscript.





2. Frame of reference

This chapter elaborates on the positioning of the thesis on a theoretical level and introduces the key concepts and references that delineate the thesis framework. The thesis is anchored in a human-centred design perspective, as it is the research tradition and work domain of the division Design & Human Factors at Chalmers University of Technology, with which I am affiliated.

The user-centred design tradition is rooted in the design research field born during the second half of the last century. It has been more than 55 years since the Design Research Society was founded and the first design methods or methodology books were published (Cross, 2007a). Before World War II design was mostly regarded as a problem-solving and decision-making activity that contributed to the creation of mechanically efficient, powerful, and long-lasting goods (Bayazit, 2004). During and after the war, the study of the human-machine relationship opened up for a more interdisciplinary approach to design (e.g., including design professionals, physiologists, medical officers, hygienists, engineers, architects, etc.) and a greater interest in ergonomics (ibid). In the 1960s a first generation of design methods attempted to 'scientise' design, with a rather simplistic and systematic approach, that was closer to a positivist rational problem-solving view. During the '70s, these methods faced harsh critique regarding their values and the underlying logic inspired by computer techniques and management theories (Cross, 2007a). A second generation of methods closer to a constructivist view of design research as a reflective practice was consequently developed. These methods approached design problems with less rigid logic and started to consider co-creative processes and user involvement (Bayazit, 2004).

In the 1980s engineering design methodologies thrived with the emergence of design research journals and events such as the International Conferences on Engineering Design (ICED) (Cross, 2007b). The 1980s and '90s were the decades

in which human-computer interaction (HCI) flourished as a research field connecting cognitive sciences to design research (Bayazit, 2004). A growing interest in and funding of design research also facilitated intellectual convergences with other disciplines such as marketing, and management disciplines (Cooper, 2019), for example, the convergence of the notions of customer-centred in marketing and user-centred in design, or the convergence between design, innovation, and creativity in the ‘design thinking’ stream that permeated the management field. Design research also engaged with disciplines such as psychology, ethnography, and anthropology in the pursuit of understanding people (ibid). Also during the 80s and 90s, the construct of usability in the field of HCI was established and defined in terms of how well users can use the functionality of a system (Nielsen, 1994, pp.25-26); that is to say, whether the system is easy to learn, efficient to use, easy to remember, minimises errors, and its use is satisfactory for the user. This way, the 1990s came to mark the expansion of the design field and its consolidation over the following decades as a research discipline based on *‘designerly’ ways of thinking and knowing* (Cross, 2007b).

The new century brought what Cooper (2019) refers to as a new wave of change, with the development of practice and theory. New sub-disciplines such as service design (Meroni and Sangiorgi, 2016) or nudging (Thaler and Sunstein, 2008) emerged where the design domain transitioned from the design of the tangible to the intangible. The late 1990s and early 2000s was also the moment in which design research more strongly challenged the instrumental focus of usability and ergonomics in HCI for being narrow. For example, authors such as Alben (1996), Jordan (2000), Norman (2004), Desmet and Hekkert (2002), and Hassenzahl (2001) acknowledged the role of design qualities beyond the instrumental that also encompass non-task-related issues and lead to positive experiences of pleasure and meaning. The irruption of these ideas in HCI expanded the field conceptually and theoretically towards, for example, emotional and cultural-historical aspects of people’s experiences (Bødker, 2006). Zimmermann (2008, p.9) noted that *“there is a shift from performance- and task-oriented systems, we use to get work efficiently and effectively done, to experiences with and through interactive systems that stimulate or please us aesthetically, psychologically, physiologically, socially, intellectually, etc.”*. A comparable evolution in the progress of the economy was also highlighted by Pine and Gilmore (2011), with the transition from an agrarian economy to an industrial economy, then on to a service economy, and finally to the experience economy.

All things considered, there has been a vast transformation of design research over time; while the design research of the 20th century focused first on machines and later on humans as a subject of study (knowledge about machines and humans), the focus changed in the 21st century to incorporate more of the humans’ subjective perspective (knowledge that humans carry). On a design level, this

implied shifting the focus from specific aspects of products and services (e.g., functionality, aesthetics, ergonomics, price, and so on), to a more holistic approach where products and services are understood as experience providers in a systemic context. This transformation of the design discipline, particularly over the last 50 years, has also been mirrored by education programmes such as Industrial Design Engineering at the Technical University of Delft in Holland (Voûte *et al.*, 2020), or Industrial Design Engineering at Chalmers University of Technology in Sweden; these and equivalent education programmes were born with the aim of supporting product development in industry, and today they are approaching more and more complex societal challenges from a systemic perspective. More importantly, the intense interplay of multiple theories and fields in recent decades has also facilitated the adoption of design by researchers outside the discipline (Cooper, 2019).

2.1. UX as the frame of reference

Experience, an experience, a user experience

Experience, taken from the Latin *experiri* (to prove, justify, evidence), is usually outlined from a linguistic angle as (i) the (accumulated) knowledge or ability acquired with the observation or the participation in an event, or events over time; and (ii) a life event that influences one's mental or physical state ("Cambridge Dictionary", n.d.). However, this refers to life experiences in general.

ISO 9241-210:2019 defines user experience as *"a person's perceptions and responses that result from the use or anticipated use of a product, system or service"*. Alben (1996) refers to the term 'experience' in interaction design as *"all the aspects of how people use an interactive product"*, such as sensorial, pragmatic or cognitive aspects of the interaction. Roto *et al.* (2011) describe UX as the experience(s) derived from the interaction with a system consisting of artefacts, services, or a constellation of these. Hence, user experiences have a narrower scope than experiences in the general sense.

From a design perspective, the concept of User Experience (UX) is holistic, complex and multi-layered, and there is plenty of literature addressing it (Ortíz Nicolás and Aurisicchio, 2011; Pettersson, 2018, pp.9-34). Hassenzahl (2011) states that *"Experience or User Experience is not about good industrial design, multi-touch, or fancy interfaces. It is about transcending the material"*. Further, *"experiences emerge from the integration of perception, action, motivation and cognition into an inseparable, meaningful whole"*. Buchenau and Suri (2000) explain that experiences are a *"very dynamic, complex and subjective phenomenon"* and that *"it depends upon the perception of multiple sensory qualities of a design, interpreted through filters relating to contextual factors"*. Forlizzi and Battarbee (2004) refer to 'co-experience' as user experience in social contexts, which take place and are shared together with others. In this sense, user

experiences are determined by the user's physical and psychological circumstances, the qualities of the system with which the user interacts, and the context of use. The 'elements' of user, system, and context are fundamental to user studies in general and they are common to other theoretical standpoints in the field of Design and Human Factors (e.g., Archer, 1963; Engeström, 2015; Karlsson, 1996). To this, Roto *et al.* (2011) add the element of temporality of experiences and distinguish four categories:

- Anticipated UX: in relation to the period before the first event of using a system, as well as user expectations about a concrete moment or outcome.
- Momentary UX: in relation to the concrete changes in a user's affective experience during interaction with a system.
- Episodic UX: in relation to the memories and reflections of a concrete episode with a system.
- Cumulative UX: in relation to the long-term appraisal of a series of episodes of use and non-use.

Pettersson *et al.* (2018) are coherent with the above-mentioned definitions of UX and distinctions of its elements, and emphasise that UX is dynamic, situated and influenced by users' affective states as well as by social and temporal aspects. Ortiz Nicolás and Aurisicchio (2011) approach the dynamic nature of experiences with the notion of interaction. The authors define interaction as *"the action accomplished by a user on an artefact that influences or modifies his or her motor, perceptive, cognitive, and affective systems. Interaction can be either physical, e.g. driving a car, or non-physical, e.g. contemplating a car; and it is a process not the fulfilment of a purpose"*. These motor, perceptive, cognitive, and affective aspects of the interaction are also referred to by Desmet (2002) and Scherer (2005) in relation to the components of emotions. Emotions, like user experiences, are part of *"the subjective side of product use"* (Hassenzahl, 2008) and suggest that users continuously evaluate and respond to the events of use they are undergoing.

The term User eXperience coined by Don Norman in the 1990s has remained a fuzzy buzzword over time (e.g., Alves *et al.*, 2014; Pettersson, 2018). In this respect, Zimmermann (2008, p.12) claims that the definition of the UX construct is an ongoing process in the research community. Among the main reasons is the diversity of fields that have adopted this construct (*ibid*). For example, Pettersson (2018) states that *"UX research can be found in the intersection of fields such as cognitive science, design, psychology, philosophy, sociology, marketing and engineering. All the different entrances to the field have their own epistemological assumptions and consequences, leading to a multitude of approaches"*. While the widespread research initiative into UX may offer considerable development prospects, it also entails different interpretations of

what UX is and its constituent elements. In this sense, UX researchers are left with a wide array of options and the need to make a sensible choice.

For the remainder of the thesis, I will refer to ‘UX’ as a research construct and as the field of my research, and to ‘a user experience’ or the ‘experiences of users’ as the phenomenon that I study from a UX perspective. Likewise, and according to my research background referred at the beginning of this chapter, I deliberately approach the construct of UX from a user-centred design perspective. This means that I consider the subjective nature of user experiences as central in the process of interacting with systems, and key to explaining the changes in the motor, perceptive, cognitive, and affective systems derived from such interaction. In this sense, Appraisal Theory (Lazarus *et al.*, 2001), a theory in cognitive emotion psychology, provides extensive theoretical grounds to explain how individuals evaluate and respond to the events that they experience.

Appraisal theory

Appraisal Theory claims that emotions are elicited by the individual’s appraisal (i.e., evaluation) of events of major relevance to her/his well-being, implying that appraisals mediate between the events and the emotions (Desmet and Hekkert, 2002; Roseman and Smith, 2001; Scherer, 2005; Smith and Lazarus, 1990). The references to appraise an event as beneficial or harmful are the individual’s concerns, in terms of needs, preferences, values, motives, etc. (Frijda *et al.*, 1986). The origin of modern appraisal theories can be traced back to the work of Magda Arnold in the 1960s (Arnold, 1960), whose initial notion of appraisals being intuitive and not deliberative rational processes resembled a reflex stimulus-response process. This notion evolved significantly over time and, from the 1980s to the present, the conception of appraisal reflects both high- and low-level cognitive processes; some of them are more complex and conscious while others are simpler and non-conscious (Lazarus and Smith, 1988). According to Roseman and Smith (2001) Appraisal Theory has contributed explanations for:

- The automatic or controlled processing of perceived, remembered, or anticipated events that elicit emotions.
- The individual and temporal differences in interpreting a given event and, consequently, experiencing dissimilar emotions.
- The fact that diverse events can elicit the same emotion due to the activation of a certain appraisal pattern.
- The existence of distinct emotions and diversity of patterns of emotional response.

In addition, it provides explanations for complicated issues such as:

- The ability of individuals to cope with situations by adapting their emotional responses and resorting to those in their repertoire that are best aligned with their own well-being (understanding needs and goals as part of well-being).
- The conflicting, involuntary, or maladaptive appraisals that account for the irrational aspects of emotional reactions.
- The changes induced in the emotional responses over time as a result of common patterns of experience in people's development, or distinct events that lead to idiosyncratic emotional reactions.

Lazarus *et al.* (2001) state that “*appraisals are usually dependent on many subtle cues in the environment, previous experience, and a host of personality variables, such as goals, situational intentions, and personal resources*” (Lazarus *et al.*, 2001, p.51). This is coherent with the definitions and components of UX introduced earlier and implies that two individuals can appraise a given event differently, leading to diverse emotions, responses and/or learnings. Multiple models in Appraisal Theory attempt to settle the specificities of the eliciting mechanism of emotional reactions, although the viewpoint that most appraisal theorists share is that “*the physiological activities, subjective feelings, expressions, behaviours, and motivational urges that comprise an emotional response are all organized around, and are in service of, the adaptational exigencies predicted by the eliciting appraisals*” (Roseman and Smith, 2001, p. 19).

Alternative theories elaborating on the causes of emotions presented their own evidence to claim that emotions can be elicited by other processes that do not involve cognitive evaluations, for example a neural stimulus-response to a caress eliciting joy, or motivational processes such as hunger eliciting distress (Salmela, 2014, pp.3-8). Moreover, the debate started between the psychologists Robert Zajonc (1923–2008) and Richard Lazarus (1922–2002) in the 1980s about the role of cognition in emotions remains mostly unresolved; Zajonc (1984) regarded Lazarus' view on cognition as excessively inclusive, to the point of blurring the boundaries between cognition, perception, and sensation. In any case, the validity of the broader view of the role of cognition on emotions continues decades later. For example, Jarymowicz, (2012) reports on automatic and reflective evaluative systems underlying emotional responses and relates emotions to different sources: “*internal versus external, sensory versus conceptual, conscious or unconscious, spontaneous or based on deliberative thinking*” (pp.20-21).

If we consider broad functional accounts of cognition with different levels of complexity and consciousness, we can support the idea that all emotions are elicited by appraisal. Conversely, if we consider cognition to require reflection and thought, we must doubt the prevailing role of appraisal and accept physiological processes, biological urges, and other non-conscious factors as elicitors of

emotions. As I see it, much of the discussion focuses on competing hierarchies that aim to establish what elicits emotions in the first place, but it seems that none of these approaches is entirely wrong; there are clear overlaps, so debating whether conscious or non-conscious processes come first is regarded as fruitless for the purposes of this thesis. I embrace a rich, dynamic, and multi-level notion of cognition, implying that conscious and subconscious processes are in continuous interaction and involve different kinds of information processing. Therefore, I regard perception and sensation as cognitive processes and consider the evidence of non-consciously elicited emotions as a different kind of appraisal. From a design perspective, one could for example relate these different kinds of appraisal to the visceral, behavioural, and reflective levels of cognitive processing discussed by Norman (2004). Furthermore, not every single stimulus is significant enough to elicit an emotional response (Lazarus *et al.*, 2001, pp.42-43). In other words, individuals cannot be constantly aware of all the information processed by their brains.

This being the case with the different kinds of appraisals, are there also different kinds of emotions? According to Scherer (2005) *“scholars from different disciplines in the humanities and the social and behavioural sciences rarely agree on everyday language concepts”* such as emotions, although systematic scientific approaches make it *“imperative to generate a minimal consensus about the defining features of the different types of [in this case] affective phenomena”*.

Emotions and other affective states

The debate about the eliciting mechanisms of emotions seems to be largely related to the definition of the construct of cognition (Salmela, 2014, pp.3-8). In the case of emotions, there is a parallel sustained discussion (Scherer, 2005). Different physiological, neurological, behavioural, and social criteria are used to define the construct of emotion and other affective states such as mood, feelings, affective dispositions, preferences, attitudes and so on. (Beedie *et al.*, 2005). Further, leading authors in the field of emotion research such as Smith and Lazarus (1990) acknowledge the difficulty of defining emotions, distinguishing them from non-emotions, and suggest that it may be a fuzzy term with many borderline states that are difficult to classify with certainty.

It seems, however, that emotions differ from moods in that they are caused by an identifiable event or directed to another individual, they have a shorter duration, are of higher intensity and result in more expressive manifestations; moods are a longer-term state of mind or background feeling of which people may be only vaguely aware; they are experienced with lower intensity and have no specific cause or direction, making them more difficult to describe accurately (Beedie *et al.*, 2005; Burleson and Planalp, 2000; Ekman and Davidson, 1994). Scherer (2005) also

differentiates emotions and moods from feelings, preferences, attitudes, affective dispositions, and interpersonal stances. In addition, Pieter Desmet (2002) brings together in his thesis the emotion and design research traditions, and proposes the discrimination of affective states into emotions, moods, sentiments and emotional traits, based on two variables: (i) the relation between the person and the object of the affective experience, and (ii) the temporal manifestation of the affective experience, for instance limited in time or enduring dispositions (Desmet, 2002, pp.3-7).

A recent publication by Jaworek *et al.* (2020) addressing emotions in workplace research, exemplifies how the lack of consensus on the terminology of different affective states requires one to make terminological choices. The authors imply that feelings are a component (subjective and evaluative) of other affective states and they consequently decide that the common denominator for their investigations must be work-related feelings concerning a particular set of emotions.

Terminological choice

I recognise the hindrance that the terminological confusion pointed out by Jaworek *et al.* (2020) entails for the study of office user experiences. In this respect, I must clarify that the debates on the various emotion research traditions and constructs are beyond my research scope. Moreover, my focus is on the investigation of user experiences with flexible offices from a design perspective. This means that I am not only interested in the outcome elicited by an appraised event, but in the complete appraisal process and the role that the design qualities of office spaces and artefacts have in such process.

In Desmet's (2002) affective terms, office users may experience emotions and sentiments towards spaces and artefacts, experience moods in relation to the event of use and the context, and base their appraisals on emotional traits (among other personal characteristics) involving a series of feelings in the process. Therefore, the experiences of using offices involve emotions and other borderline constructs. Accordingly, the broader term 'affects' or 'affective states' is preferred here instead of emotions when referring to the response elicited by the appraisal process as described in Appraisal Theory.

2.2. Models of how user experiences take place

Desmet's (2002, p.107) model of emotions captures the reasoning of the appraisal process and the intervening variables from a design perspective. According to this model, an emotion (i.e. a specific type of affective state) is elicited by the appraised significance of the given stimulus for the individual's concerns (Figure 1).

Desmet refers to established appraisal models to distinguish between the appraisal of appealingness, legitimacy, motive compliance and novelty, depending on whether a stimulus relates to an individual's concerns (e.g. preferences, beliefs and standards, goals) or to knowledge and expectations. Further, the model discriminates the appraised stimuli by their roles as an object, agent, or event, depending on whether the appraisal concentrates on the qualities of a 'thing', the actions of a 'thing' causing or contributing to an event, or the (anticipated or past) consequences of an event respectively.

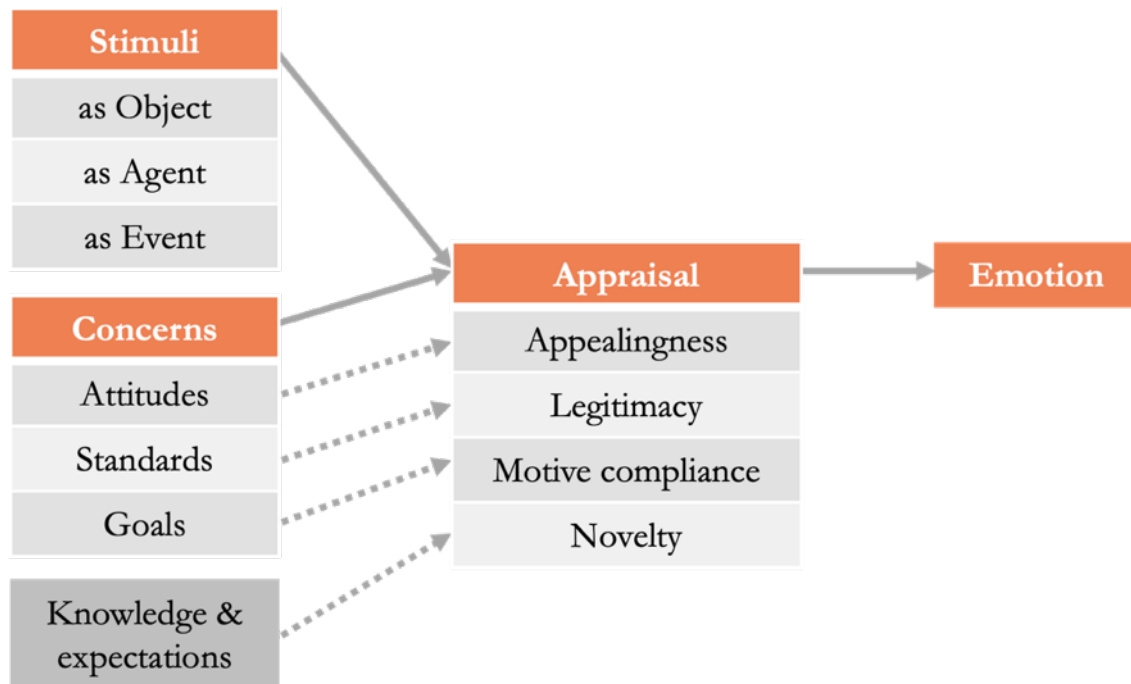


Figure 1. Desmet's basic model of emotions

However, Desmet (2002) focuses on product appearance and visual experiences, appearance being one type of stimulus. Stimuli involving other senses would result in different emotions, even in emotions that appearance cannot trigger. His 'general model of product emotions' is applicable in principle to any emotion, but his work concerns the perception of the product, not its 'consumption' (seeing vs. consuming in Desmet, 2002, p.xii). The author deliberately and justifiably excluded the emotions elicited by 'consuming' a product, such as buying, using, owning, (and one could add creating, configuring, repairing, breaking, discarding, or remembering among other situations). This also implies that the focus is on experiences of products by 'passive observers' and not by 'active users'.

Users can actively pursue certain affective experiences, and the attempts may result in expected or unexpected outcomes. This group of 'active users' seems better represented in Roto's (2006, pp.20-33) stance on user experience as a term clearly differentiated with plain experience. Roto's model requires the active intervention (with or without purpose) of the user on the system, *"using means that the user not*

only senses the system, but also has the opportunity to manipulate or control the system” (p.33). In cases where the user has no control over the system, the term ‘experience’ (without ‘user’) is preferred. Moreover, Roto differentiates between the user experience in a use case and the overall user experience consisting of a number of use cases, perceptions and information received beyond the use cases (Figure 2). In this sense, the term ‘user experience’ by Roto is similar to the term ‘an experience’ by Forlizzi and Battarbee (2004) as it implies a clear beginning and end of the interaction with a system, although Forlizzi and Battarbee seem to have a broader view on the kind of interactions that makes ‘an experience’ a ‘user experience’.

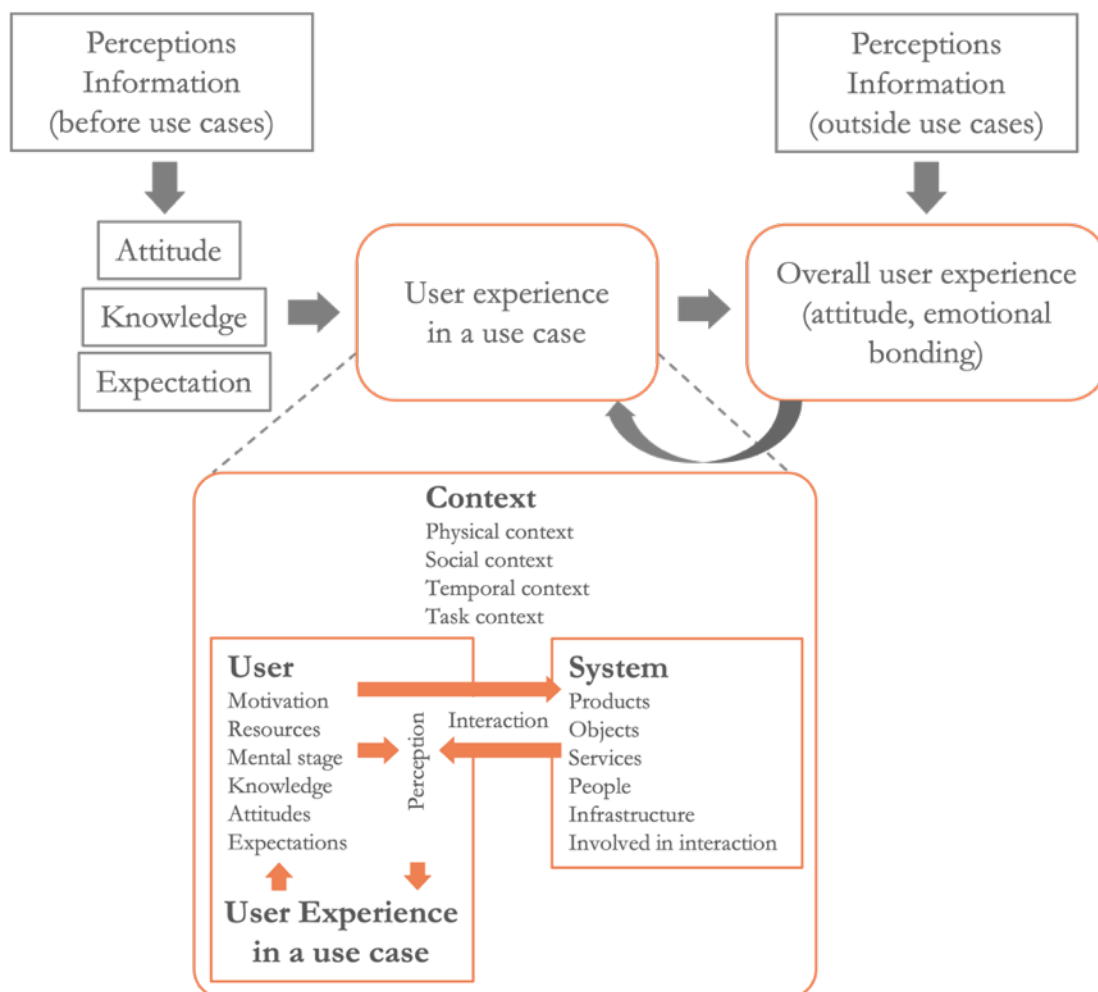


Figure 2. Roto's (2006) representation of UX building blocks

The CUE-model by Thüning and Mahlke (2007) where CUE stand for components of user experience also consider the active role of users in the experience (figure 3). The authors distinguish three components of a user experience: (i) perception of instrumental qualities, (ii) perception of non-instrumental qualities, and (iii) emotional reactions. These components, as in the case of Roto (2006) presume the interaction of a user with a system. In particular, the first component on instrumental qualities mainly relates to usability aspects.

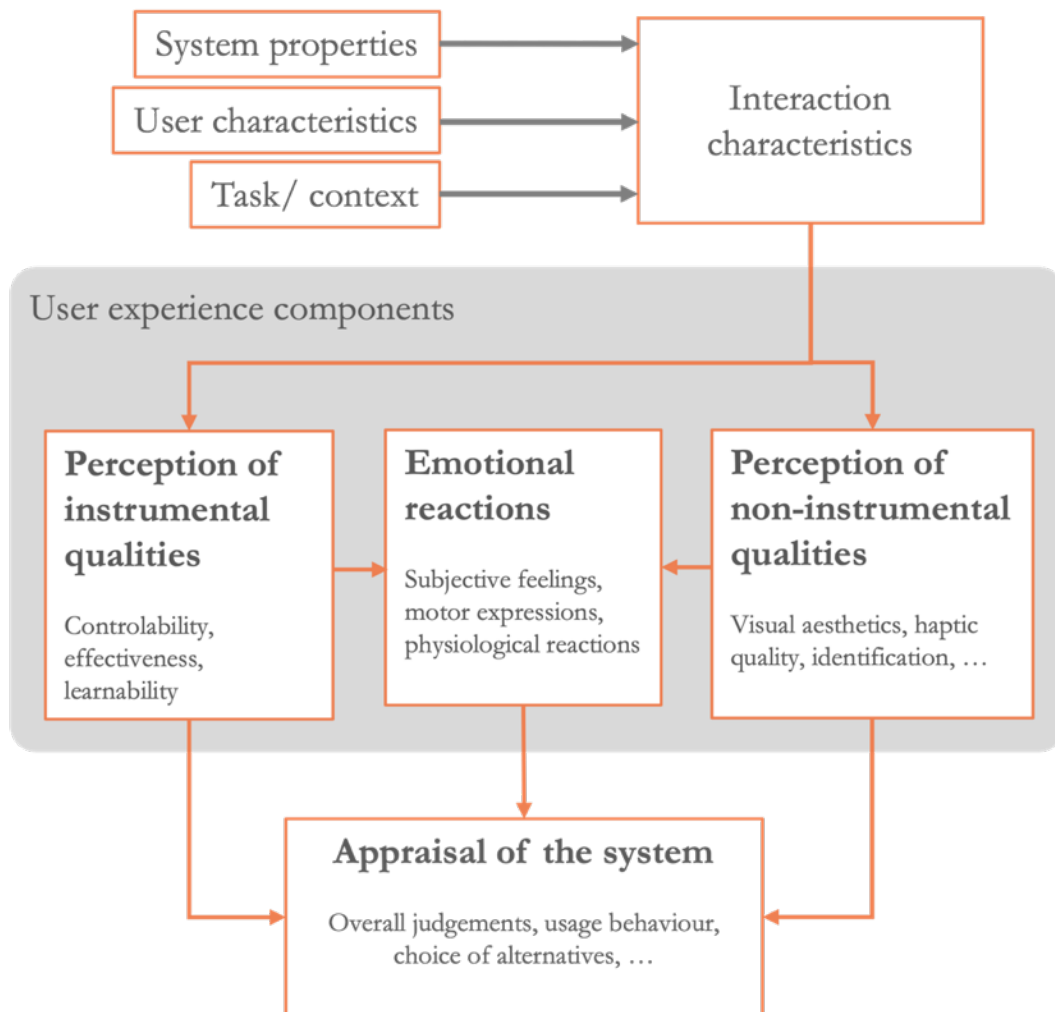


Figure 3. The CUE-Model by Thüring and Mahlke (2007)

Hassenzahl (2003) also implies a similar role for users in the user experience. In this case, the instrumental qualities are referred to as ‘pragmatic’ and the non-instrumental ones as ‘hedonic’. His model brings together the designer’s intentionality with the product and the user’s perception and appraisal of the product (Figure 4). Designers ‘equip’ products with a series of features aiming for a set of pragmatic and hedonic qualities that users will interpret in their own terms. Users may appraise products differently when interacting with/manipulating them, resulting in diverse experiential outcomes that the author refers to as “*emotional consequences such as satisfaction or pleasure*” (p. 308).

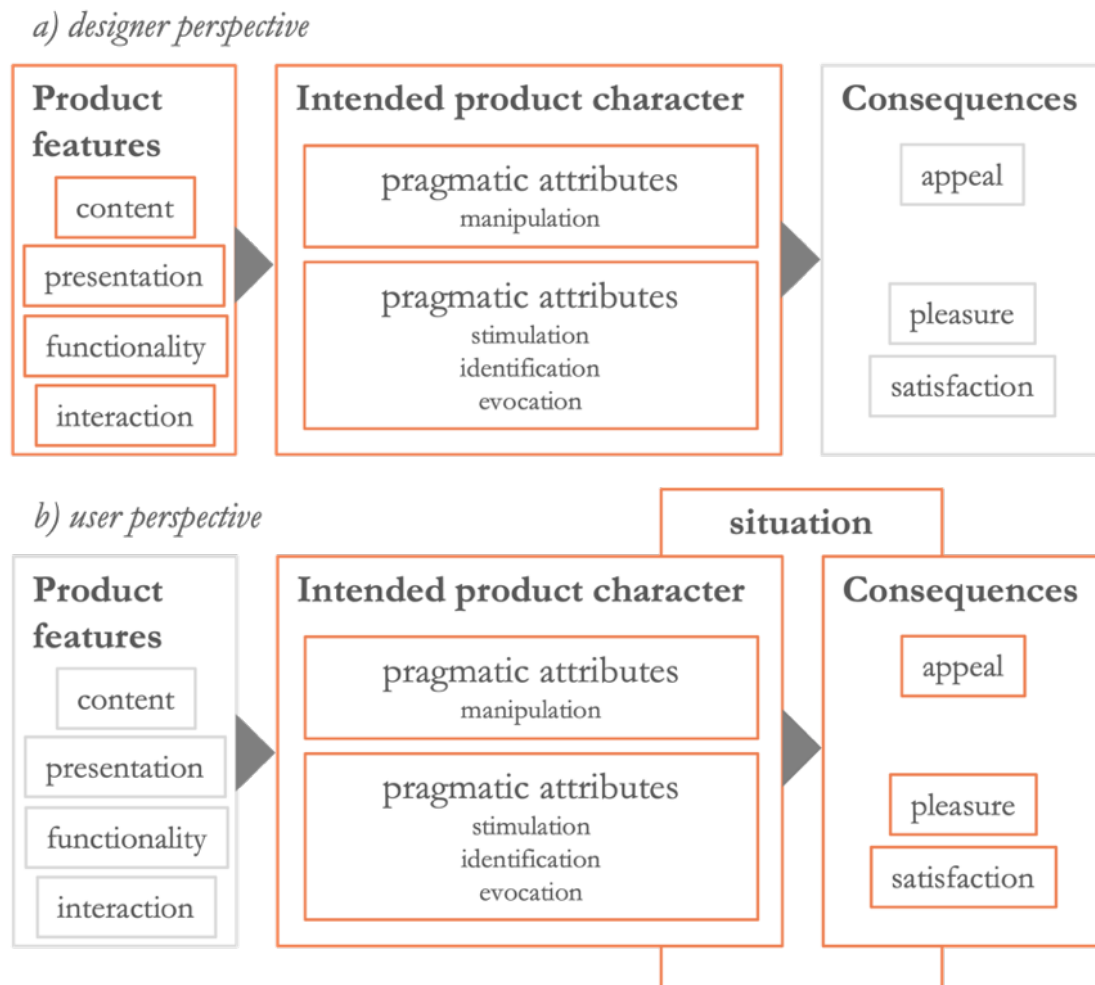


Figure 4. Hassenzahl's (2003) model of user experience from a designer and a user perspective

Forlizzi and Battarbee (2004) go a step further with a framework that distinguishes three different types of user-product interactions:

- **Fluent:** automatic/interiorised interactions such as riding a bicycle.
- **Cognitive:** interactions that focus on the system in use and result in knowledge or error, for instance trying to figure out how to operate a mechanism.
- **Expressive:** interactions that contribute to a bond between the user and the product, such as setting a background picture on a device.

These interactions in a context of use yield three types of experience:

- **Experience:** as the self-narrative stream occurring during the interaction, such as walking in a park.
- **An experience:** as an event that can be named, has a beginning and end, and may trigger emotional and behavioural changes, for instance going on a roller-coaster ride.

- Co-experience: as an event in a social context where experiences are created or shared with others, for example playing a game with friends.

Note that in this case, the notion of experience and user experience have different connotations than in Roto's case (2006), as Forlizzi and Battarbee (2004) also regard cases where users have no control (e.g., a roller coaster ride) as a type of user experience. Forlizzi and Battarbee's (2004) framework is coherent with other authors in the field such as Norman (2013) where experiences are described by the cognitive levels of processing that these involve (i.e., visceral, behavioural and reflective), rather than the kind of interaction (e.g., physical contact, contextual immersion, contemplation, etc.). In this case, Norman (2013, p.50) states that *"visceral and behavioural levels are subconscious and the home of basic emotions. The reflective level is where conscious thought and decision-making reside, as well as the highest level of emotions"*.

Jordan's (2000) Four Product Pleasures was one of the pioneering models in explaining the experiences that users have with products beyond the instrumental implications. According to Jordan, users can experience four types of pleasures with the use of products, which are also pleasures that humans pursue in life:

- Physio-pleasure: derived from the human senses, for example due to the appearance, smell, taste, texture, or temperature of a pizza.
- Psycho-pleasure: derived from people's cognitive and emotional reactions, such as a product that is easy to use resulting in higher psycho-pleasure than a product that is difficult to use.
- Socio-pleasure: derived from relationships with others and/or society, for instance due to a product's ability to enable and enhance social interaction.
- Ideo-pleasure: derived from people's ideals, tastes, aspirations, and values, for example due to a product such as the Fairphone and its emphasis on an ethical, more sustainable design.

In all these cases, overlaps are observed regarding the respective authors' understanding of UX, although they choose to categorise UX components differently. For example, the CUE model explicitly narrows down the UX components to three (i.e., perception of instrumental qualities, emotional reactions, and perception of non-instrumental qualities), while Desmet's and Roto's models consider other elements such as the user characteristics or use context to be UX components too. Moreover, the research work of authors such as Hassenzahl and Roto seem more oriented to user experiences with digital products, while the work of Jordan, Desmet, and Norman is more relatable to experiences with physical products.

In this respect, Zimmermann (2008, p.12) regards the inclusion and exclusion of UX components as arbitrary and the research orientation as dependent on the background and interest of the respective authors. These different perspectives have been further reported and synthesised in the review of UX theories, models, and frameworks by Ortíz Nicolás and Aurisicchio (2011) and in Pettersson (2018). In consequence, the field seems to remain in disarray despite the numerous attempts at clarification.

2.3. Synthesis and personal standpoint

The frame of reference introduced earlier provides insights into the numerous thoughts and views on the nature of user experiences. In this sense, I do not intend to establish additional definitions or angles on the construct of UX, but rather make choices and bring structure to the study of user experiences. In this thesis, I do that by building upon the work of relevant UX researchers in the user-centred design tradition.

The following references have been considered here to propose the conceptual model that I already introduced in the appended publication D for the study of user experiences with flexible office environments:

- The notion of UX by Hassenzahl (2011) and Roto *et al.* (2011)
- The model of product emotions by Desmet (2002) and the premises from Appraisal Theory on which it is based.
- The take on interaction by Ortíz Nicolás and Aurisicchio (2011).

According to this perspective, user experiences can only be understood in relation to the user who experiences it. These experiences can be described as a cyclical process involving the phases of stimuli, user evaluation of the stimuli, and experiential outcomes derived from such evaluation (Figure 5). Eventually, new stimuli or responses of the user to the perceived stimuli would trigger a new experiential cycle.

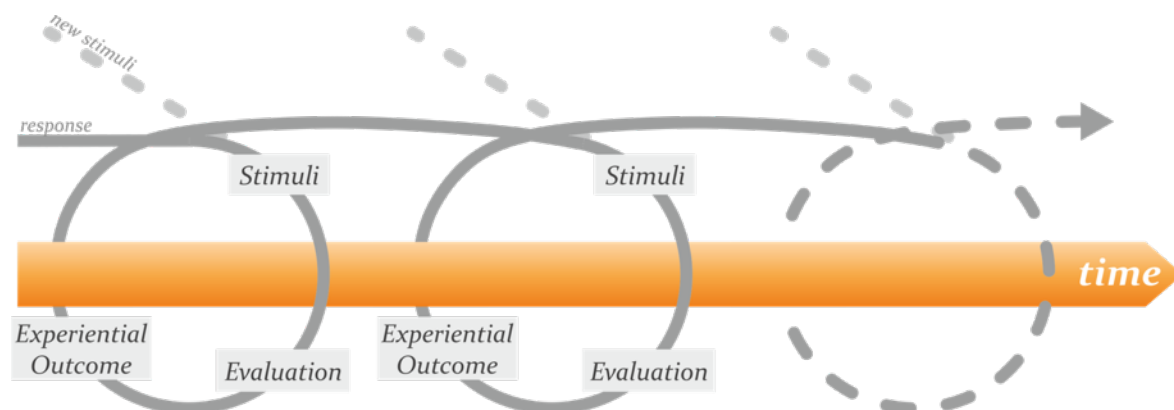


Figure 5. Experiential cycle.

Zooming into this UX cycle, the phase of stimuli is the starting point for the user experience. It consists of an anticipated, perceived, or remembered event of use of a system (i.e., office artefact, space, or constellation of both in this case) in a context, that is mediated by the design qualities of the system in use. The next phase is the evaluation, in which the user appraises whether the stimuli are relevant or not for her/his own well-being. These appraisal processes, as indicated in Appraisal Theory and Desmet's model, often occur on a subconscious, automatic cognitive level, and are mediated by the user's concerns, abilities, knowledge, and expectations. Only the events appraised as significant for user well-being will elicit experiential outcomes and, eventually, user responses to the appraised stimuli (Figure 6). Such responses represent the agency of users, who are not mere spectators of the events; they may decide to pursue particular experiences or influence their course.

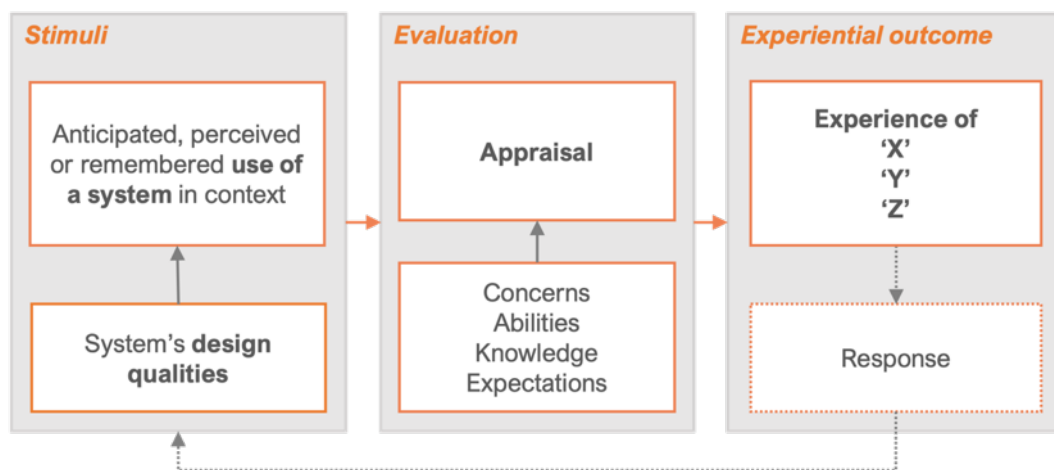


Figure 6. Representation of how UX takes place.

The fundamental reason why this model is proposed and taken as a reference in this thesis lies in the necessity to approach the complexity of UX in a manageable and systematic manner. It also serves to report the findings of my research activities in an accessible and structured way. It synthesises and provides a simplified representation of the line of thought outlined by the UX literature reviewed in this chapter and the central role of Appraisal Theory in the study of user experiences.

Research implications for the study of flexible offices

The frame of reference adopted in this thesis entails a series of implications for the research problem addressed in this thesis. First, investigating the influence of the system's design qualities (spaces and artefacts) on experiences with flexible offices requires **(i) capturing insights on how users appraise these systems in use, and (ii) understanding the resulting experiential outcomes.** Next, utilising the knowledge acquired to explore design opportunities for positive

experiences with flexible offices involves **gaining a rich understanding of what users anticipate, perceive, or remember about using a system, as well as its outcomes**. In the words of Zimmermann (2008, p.9), it is not only about how a system is used, *“but why, and if, people like and use certain products (and why not others) and what they gain from using it”*. In this respect, the model presented in Figure 6 works like a map that allows me to identify the elements of the experiential phenomena studied and their connections.

The particular research domain of this thesis – flexible offices – implies distinctive stimuli with multiple artefacts and spaces in multi-user environments that are key to gaining insight into the experiential process. As highlighted in the introduction, the study of user experiences in multi-user, multi-touchpoint environments is not common in UX literature. Applying this UX angle in the study of offices is not common either. In this sense, the thesis contributes to both literature on UX and office user studies.

This endeavour is not exempt from challenges, as collecting data on user experiences requires gaining knowledge beyond the explicit and readily observable, while considering their dynamic and multi-layered nature. As described in Visser *et al.* (2005) understanding what people feel and why requires reaching deeper levels of knowledge (i.e., tacit and latent). In this regard, the next chapter elaborates on how I have approached the study of experiences on a methodological level.





3. Research approach

This chapter elaborates on the research approach of the thesis. It comprises an introduction to my ontological and epistemological standpoints, the relationships between the research questions formulated and the research conducted, and descriptions of the steps and activities undertaken.

3.1. Research standpoint

From an ontological standpoint, I believe that humans make sense of their own reality by interacting with their surrounding world and attributing meaning to what is perceived. Likewise, science is rooted in human societies and cultures, meaning that scientific ‘truths’, knowledge, values, religions, lifestyles, and so on are products of social endeavours, agreements, and disagreements. This belief aligns my research with constructivist worldviews (cf. Creswell, 2014, pp.8-9), which in essence state that scientific knowledge is a human creation and a product of social processes (Golinski, 2008, p.6). Accordingly, one cannot expect research to be fully unbiased and independent of the context in which it is conducted (Mckay and Marshall, 2001). The context plays a relevant role in the study and understanding of a phenomenon (ibid). For the same reasons, the user experiences that I study are very much dependent on who experiences what, when, and where. Therefore, my ambition as a user researcher has always been to see the world through the user’s lens, giving transparent accounts of the work done to mitigate my own potential biases or influences on what was being investigated.

In this thesis, the research questions explicitly refer to the design qualities of the artefacts and spaces in (events of) use, but the experiences must be understood in relation to how users appraise these qualities, within a particular psycho-social and dynamic context. In this regard, I have prioritised the collection of qualitative first-hand data, and a research strategy consisting of acquiring knowledge with case studies and utilising it to acquire further knowledge. Likewise, I have chosen

different theoretical perspectives and methodologies during my doctoral studies according to what these could contribute to solving the research problem formulated (cf. pragmatic view on research in Creswell, 2014, pp.10-11).

On an epistemological level, research question 1 relates to the early research activities conducted in my doctoral studies. These mostly have a descriptive and explanatory character, that is to say the study of the ‘what’ and ‘how’ of experiences with flexible offices.

- RQ1. What design qualities of spaces and artefacts in flexible offices influence the user experience? How?

Given the subjective, multidimensional, and context-dependent nature of user experiences, and the unique circumstances of every office environment, the studies conducted at this stage were designed to elicit rich insights from smaller samples. This demanded a triangulation of methods to be able to capture users’ insights about their flexible offices, as well as deeper knowledge on what they do, use, or feel as part of their individual experiences (cf. Visser *et al.*, 2005). The acquisition of in-depth knowledge on user experiences also helped me explain why these experiences take place. The office user studies were structured following a convergent parallel mixed method approach (Creswell, 2014, p.15), meaning that qualitative and quantitative data were collected at approximately the same time and the findings from separate analyses were integrated into the overall results.

Based on the understanding of user experiences with flexible offices, my research transitioned to a new stage of development that corresponds to research questions 2 and 3.

- RQ2. What design implications are there to consider for improving the user experience with flexible offices?
- RQ3. How (if possible) can one design for positive user experiences with flexible offices?

The insights gained with question 1 were utilised at this point to draw design implications and explore design opportunities for positive experiences with flexible offices. This also implied testing such interventions with users in their office environments. Accordingly, my role as a researcher observing phenomena in the first stage became more participative in this latter stage. In this sense, one could say that the earlier stage of my doctoral studies aligns with what Forlizzi *et al.* (2009) describe as ‘research for design’, in other words theoretical outcomes (e.g., conceptual frameworks, guiding philosophies, and design implications arising from the investigation of people, contexts, and mediating artefacts) produced for application in the design practice. The latter stage aligns with ‘research through design’, that is to say an approach that utilises design as part of

the inquiry, allows researchers to participate actively in the creative process, and can produce theoretical outcomes in the area of ‘research for design’ (ibid). In short, the research included in this thesis are based on the following premises:

- Practical hands-on approach for the empirical study of a research problem prioritising first-hand data.
- A system perspective on flexible offices with a focus on the interrelation between users and the spaces and artefacts in use.
- Case studies in real office environments.
- Emphasis on the users’ subjective experiences.
- Triangulation of (mostly) qualitative and quantitative methods.
- Inductive analysis processes to identify patterns and trends in the extensive qualitative datasets, plus deductive analysis processes to cluster insights according to selected frames of reference.
- Utilisation of generated knowledge to deepen the study of user experiences.

The in-depth investigation of the research problem presented in the introduction involved multiple research activities that are described in the following subsections. Multiple-case study strategies are considered appropriate to investigate novel or complex matters in their real-life context (e.g., Eisenhardt and Graebner, 2007; Yin, 2009, p.4; p.18). This enabled the identification of both case-unique and overlapping findings that facilitated their contextualisation and comparison. Contextualising and comparing findings on user experiences are essential to understand the preconditions in which certain experiential outcomes occur, and for designing the preconditions for new/better experiences.

The remainder of this chapter provides an overview of the research activities conducted that have been included in this thesis (see list in Table 1), how these relate to the research questions and the appended publications, and how these contribute altogether to the whole of the thesis.

Table 1. List of research activities included in the thesis and related publications

<i>Research activity</i>	<i>Related publications</i>
<i>Study Ia. Post-relocation to a combi office</i>	A & B
<i>Study Ib. Follow-up & longitudinal perspective on Ia</i>	C
<i>Study II. Post-relocation to an activity-based flexible office</i>	D
<i>Collaborative ‘Design for UX’ project with an industrial partner</i>	E
<i>Study III. User tests with research prototypes</i>	F
<i>Cross-case review and theoretical developments</i>	Chapter 5

3.2. Study Ia. Post-relocation to a combi office

Study Ia (publications A & B) aimed at gaining an in-depth understanding of the influences that the design qualities of the physical environment have on users' appraisal of how pleasurable and meaningful the flexible office was and, related to this, the use that users made of the office. The study concerns a division of a university department that relocated from cell offices to a combi office six months before the data collection took place. A total of 36 employees from that division were working at the new office on a regular basis. They were invited to take part in the study. Other employees who were working part-time or in remote locations were excluded. In total, 16 of the employees participated in the study (approximately 45% of the population studied).

The data collection involved (mostly) qualitative and quantitative data: (i) individual semi-structured interviews with the 16 employees, (ii) a semi-structured interview with the architect responsible for the renovation of the new office building, (iii) structured observations of the office environment, and (iv) the study of documentation related to the building and the relocation process. The findings from the data analysis were presented to the division employees invited to the study to collect additional feedback and get confirmation.

The analysis focused on capturing both individual experiences and patterns or themes on a collective level. The dataset collected with the interviews, observations, and study of documentation was analysed from a two-fold perspective. The first involved well-being theories in the field of positive psychology for the appraisal of the office's pleasurability and meaningfulness. In this case, the construct of well-being was defined by a number of hedonic components (satisfaction and affects) (Diener, 1984) and eudaimonic components (personal evaluation, social relations, autonomy, environmental mastery, purpose, and personal growth) (Ryff, Carol, 1989). This first analysis corresponds to the work published in the appended publication A. The second analytical perspective took Activity Theory as the frame of reference (Babapour *et al.*, 2021; Engeström *et al.*, 1999). The focus was on the use of the flexible office spaces and artefacts therein in relation to employees' motives, needs and preferences. This second analysis corresponds to the research work published in publication B.

Several design qualities were identified that influenced employee well-being and office use to different extents, and the underlying reasons for such influences were revealed. The quantitative data from the observations was mainly used to describe the occupancy of the spaces and support the findings from the qualitative analysis. The interview with the architect and the study of documentation on the building and the relocation process contributed to the validation and contextualisation of findings.

3.3. Study Ib. Follow-up & longitudinal perspective on Ia

Study Ib (publication C) is a follow-up of study Ia and aimed at understanding the evolution of interrelations between users' appraisals of the same flexible office and their perceived well-being over time. The same university division was invited to participate two years after their relocation (i.e., 18 months after study Ia), where 17 out of 35 employees working regularly at the office participated as informants. Of these, 11 had participated in the previous study too. To allow for comparisons between studies and identify short- and long-term effects, the methodological approach of study Ia was replicated for this second study, with semi-structured individual interviews and structured observations of the office environment.

The notion of well-being was connected in this case to the salutogenic construct of 'sense of coherence' and its components of comprehensibility, manageability, and meaningfulness (Antonovsky, 1987). Adapted to the office context, the sense of coherence determines an office user's ability to thrive in the work environment while coping effectively with stressors. The preliminary results were presented to the studied university division, as in the first study, to gather additional feedback and confirmation.

In the analysis, findings from both studies Ia and Ib were compared and contrasted to obtain the longitudinal perspective on the studied matters. Such analysis also enabled understanding of the reasons why some design qualities of the office spaces and artefacts were perceived over time in the way they were. The data from the observations once again served to support and complement the qualitative findings from the interviews. The appended publication C elaborates on those design qualities that had a similar (positive or negative) influence on users' perceptions over time, and those that changed for better or worse. Contextual aspects were also considered and discussed in relation to the findings.

3.4. Study II. Post-relocation to an activity-based flexible office

Study II (publication D) belongs to a larger research project in the public service sector that assessed how relocations to flexible offices affect the employees of different organisations. The aim of the study was to investigate the experiences that employees (as users) had with a flexible office, regarding the design qualities of the spaces and artefacts therein. The study population concerned approximately 400 users affiliated to 12 units of an organisation that relocated from nine different cell offices to a single flexible office. The goals of gathering these work units under the same roof were to facilitate collaboration between them and make more efficient use of the premises.

The data collection was conducted 12 months post-relocation and 52 users participated as informants. The methodology adopted for the data collection involved 11 focus groups, a UX-curve mapping per informant, 11 spatial walkthroughs prior to the interviews, and structured observations of the office environment for one week (see UX-curve mapping and spatial walkthroughs in publication G). Data from three online survey studies was also available (the data was collected and facilitated by the Institute of Stress Medicine², as part of an agreement for collaboration in relation to the execution of study II); one conducted two months before the relocation, and two follow-ups conducted six and 18 months after the relocation. The survey data helped contextualise the insights from the (mostly) qualitative inquiry 12 months post-relocation into the long-term perspective.

The data collected was analysed according to a UX framework elaborated for the occasion, and that is also the framework for this thesis. In the analysis, situations of using office spaces and artefacts that resulted in positive and negative experiences were identified. Next, the underlying reasons for such situations were elucidated and the experiential outcomes were clustered by themes. The triangulation of data sources made it possible to compare, contrast, and integrate complementary findings, and gain a rich understanding of the users' experiences both in the short and long terms. The experiential outcomes were identified, and the design implications of such findings are presented and discussed in the appended publication D.

3.5. Collaborative 'Design for UX' project with an industrial partner

A collaborative 'Design for UX' project was conducted with a Nordic furniture manufacturer (publication E). This project corresponds to the first part of a larger 'Research through Design' (RtD) project that comprises the later research activities of my doctoral studies. The aim of the collaborative project was to explore design opportunities for positive user experiences with flexible offices using knowledge and expertise from design research and practice together. The collaboration involved two researchers from the Chalmers University of Technology (me being one of those) and eight practitioners from the furniture manufacturer. The researchers had a user-centred design background and contributed their knowledge of UX theories, frameworks, and methods to facilitate the exploration of design opportunities. The practitioners were affiliated

² Institute of Stress Medicine (Institutet för Stressmedicin) is a knowledge center of the Västra Götaland region (Sweden) that conducts research, development, and dissemination of work in the areas of stress, health, and psychosocial work environment.

with product design and development, marketing, and office planning. They contributed their expertise in designing office spaces and artefacts for the users to use, as well as knowledge of the implications of translating complex user needs into tangible and commercially feasible solutions.

The departure point of the project was the research previously completed in my doctoral studies. Findings from earlier research and studies of real office environments were used to discuss the relevance of suboptimal user experiences with flexible offices, prioritise them, and choose one to be improved. Based on the chosen suboptimal experience, the opposite (optimal) experience was proposed as the goal for a meaningful ‘design for UX’ intervention. Next, design strategies on how to deliver such a proposal were explored and, finally, conceptual designs that could materialise a solution according to a set of strategies were ideated, discussed, and screened.

The collaborative process consisted of seven sessions plus preparatory activities to sensitise practitioners with the theme, UX concepts, and activities of each session. Diverse activities and methods were used depending on (i) the sessions being online (due to the pandemic situation) or in person, (ii) the planned tasks for each session (e.g., explore, discuss, ideate, decide, etc.), (iii) the kind of insights that the methods could contribute, (iv) the time available, (v) the number of participants vs. facilitators, and (vi) the familiarity of participants with digital/analogical creative tools. The series of sessions culminated with an office furniture concept to be prototyped and tested with users in real office environments. Insights on the collaborative process and the sessions are provided in the appended publication E.

3.6. Study III. User tests with research prototypes

Study III (publication F) is the continuation of the RtD project, and it involved the prototyping and user testing in two real office environments of the concept resulting from the collaboration with the furniture manufacturer. The furniture concept was intended to enable a positive user experience of control over sound stimuli and related distractions in flexible offices. Accordingly, the objectives of this study were to (i) continue the explorative process of design opportunities for positive user experiences in relation to the prototyped concept, (ii) and gain a deeper understanding on how to design for positive experiences with flexible offices to take place. Two units of the prototype with identical appearance but different structural and acoustic properties were installed and tested in the offices. The feedback collected was used to iterate the first version of the prototype and then conduct one more user test in one of the offices with one unit of a second prototype. The prototypes themselves acted as research tools to gain relevant

insights on the opportunities to improve user experiences with flexible offices, and they also served to validate findings from previous research.

The methodological approach consisted of a series of digital and paper questionnaires complemented with group interviews. The questionnaires intended to measure the user experience with the prototype before, during, and after use to gain a precise understanding of the user experience over time as well as what, when and how could be improved. These questionnaires comprised a set of variables relating to overall impressions and aesthetic, pragmatic, symbolic, sensorial, and emotional aspects. The group interviews were intended to contextualise the results from the questionnaires and discuss with users potential improvements in the concept for a more positive experience.

The first office where the prototype was tested was an open plan office at an IT company with an approximate capacity of 40 workstations, divided into three zones: one for assigned workstations, one for shared workstations, and one for shared workstations rented out to externals. Here, a total of 12 users completed the study with the first prototype. The second case was an activity-based office of a company in the real estate sector. It had 42 workstations distributed in different open areas and multiple back-up spaces for different activities and levels of interaction. The users could choose different zones according to their preferences and, in this case, their work routines were highly interactive and required most of them to switch locations within and out of the office to meet colleagues and customers. Here, a total of 12 users completed the study with the first prototype plus a second round with a second version of the prototype developed in accordance with users' feedback on the first prototype. The second version of the prototype was tested in the second office only. The choice of the real estate company for the second round was motivated by two facts: first, it was fully flexible, and all the workstations were used by the same organisation; and second, this office was a tougher challenge for the prototype as there was a richer diversity of spaces covering the needs of the users, and many of those users were experts involved in the planning of office facilities.

Testing the first prototype in two offices allowed for comparisons of the experience with the prototype in two different contexts; testing the second prototype in the second office allowed for comparisons between the first and second versions of the prototype. All the details on the tests and findings are reported in the appended publication F.

3.7. Cross-case review and theoretical development

The different research activities described earlier approached the experiences that office users have with flexible offices from slightly different angles. Accordingly, there were findings unique to each activity, but also overlapping findings on how

experiences take place. In Chapter 4, Findings, the findings from each of those research activities were consistently revisited from the UX viewpoint introduced in Chapter 2, Frame of Reference. This was done to identify the main themes and trends across cases that would allow me to answer my research questions on a global level.

Additionally, this review of findings, together with literature on UX theories and frameworks, allowed me to gain a deeper understanding of the process of users experiencing ‘systems’, and how such process results in distinct experiential outcomes. Subsequently, as a complementary contribution of the thesis, I propose the tentative SEEX (Stimuli-Evaluation-Experiential outcome) model for the study of UX with offices in Chapter 5. To conceive this model, I have departed from the representation of how UX takes place in Chapter 2 (Figure 6) and mapped its components in further detail, and even added new ones.

3.8. How the pieces of the puzzle fit together

The research included in this thesis comprises three stages or areas of development in my doctoral studies:

- (i). The acquisition of knowledge of the influences of spaces’ and artefacts’ design qualities on user experiences with flexible offices through the study of literature and studies in real office environments.
- (ii). The utilisation of such knowledge to draw design implications and gain further knowledge through the exploration of design opportunities for positive experiences with flexible offices.
- (iii). Theoretical developments resulting from the research process.

Stage 1. Knowledge acquisition

The first stage concerns the acquisition of knowledge through the study of literature on flexible offices and the first three studies conducted in real office environments. Such knowledge contributed to understanding and explaining how the design qualities of the spaces and artefacts in use in flexible offices mediated user experiences with flexible offices. Further, knowledge was gained on how these experiences related to the use that users made of their flexible offices. Thus, this first stage relates to the appended publications A to D and primarily answers the research question 1

- RQ1. What design qualities of spaces and artefacts in flexible offices influence the user experience? How?

As highlighted in the previous chapters, earlier research has attempted to explain how users perceive and use their offices from diverse disciplines. Similarly, the first three studies included in the thesis investigated office users’ experiences from

different theoretical backgrounds, such as well-being theories in positive psychology and activity theory in study Ia, sense of coherence theory in study Ib, and user experience in study II.

The convergence of these theoretical backgrounds into a UX framework for the thesis was motivated by the possibility to cover the different aspects of user experiences with a single, holistic, theoretical approach and broader methodological opportunities. For example, the well-being theories and sense of coherence theory were useful to explain the extent to which an office was pleasurable and meaningful for the users but there was no evident strategy to operationalise concepts and assess the experience of well-being or health beyond generic questionnaires in the field of psychology. Activity theory was more explicit and ‘hands-on’ in this regard, but its principles still lie closer to usability than to user experience; it focuses on the matches and mismatches between user(s), tool(s), and motive(s), but does not consider anticipated UX (e.g., a user anticipating a mismatch between a tool and a motive). In addition, the unit of analysis is the activity carried out by an individual with a motive (i.e., directing a ‘doing’ towards an ‘object’), meaning that events in which users have no particular motive but still perceive and appraise surrounding stimuli (i.e., they are passive subjects of the interaction with a system) are not explicitly addressed. Most importantly, as highlighted in Chapter 1, the study of office user experiences from a UX angle has been mostly neglected.

In my research, the different theoretical perspectives adopted enabled the elicitation of rich data to gain a deep understanding of what, how and why users perceive and use their flexible office environments as they do. To this understanding contributed the use of well-known methods for office user studies such as interviews and questionnaires, as well as additional methods such as card sorting, spatial walkthroughs or UX curves that were adapted/developed for the specific purpose of each of the studies. In this regard, insights on the methodological contributions have been reported in the appended publication G.

Stage 2. Knowledge utilisation

Contributing knowledge to the literature on office studies with the UX angle and to UX literature with studies in offices is already a relevant outcome for this thesis. However, as highlighted in the introduction, action is needed too, and as a researcher with a background in industrial design engineering, there has always been a consistent thought underlying my research and learning process:

I can't just know things; I need to do something meaningful about it!

This motivated a second stage of the thesis in which I used my research findings from the first stage to draw design implications and acquire further knowledge

while exploring design opportunities for positive user experience with flexible offices. The research conducted in this stage is linked to the appended publications E and F and contributed to answering research questions 2 and 3.

- RQ2. What design implications are there to consider for improving the user experience with flexible offices?
- RQ3. How (if possible) can one design for positive user experiences with flexible offices?

The first three studies included in the first stage partly answer question 2 as well, since design implications and opportunities are highlighted and discussed in every case (publications A-D). Still, a more comprehensive understanding of user experiences from a design perspective called for exploring design opportunities and testing ideas by putting knowledge into practice.

To this end, first, the collaborative Design for UX project was conducted (publication E), and then the prototypes were tested with users and redesigned (publication F), following a Research through Design approach (RtD). RtD involves the making of designerly activities that enable designers and non-designers to define future artefacts, concerns, opportunities, experiences and ways of living (Sanders and Stappers, 2014). In later stages of design processes, these designerly activities tend to result in a prototype that confronts the world and the user beyond theoretical abstractions. As a research artefact, the prototype makes it possible to reflect, measure, discuss and analyse the effects of design interventions (Stappers and Giaccardi, 2017, p.21). Furthermore, these activities often involve iterative processes intended *“not only to achieving a local improvement in a single product or situation but also serve to discover, exemplify, clarify, and promote more general principles, which can be used elsewhere”* (ibid). The level of fidelity of the prototype representation of a final product can vary and evolve along with the iterations and according to the idea/knowledge to be tested/validated (Keyson and Bruns Alonso, 2009). In this case, high-fidelity prototypes were built to collect realistic feedback from users in real office contexts via the impression of a finished product.

Stage 3. Theoretical development

The third stage corresponds to a theoretical development resulting from the research work conducted up until this point. A joint analysis of the studies provided insights and evidence on how user experiences take place in the office context. In this regard, a tentative model is proposed and motivated in the fifth chapter of this thesis, that contributes to structuring the study of UX with offices, mapping experiential processes in general, and better understanding the research problem investigated in this thesis. Given that this third stage is the result of

previous work coming together on a more abstract level of analysis, it does not relate to any of the research questions; instead, this represents an additional outcome enriching the contribution of this thesis.

An overview clarifying the connections between research questions, research activities conducted, appended publications and the thesis is shown in Figure 7.

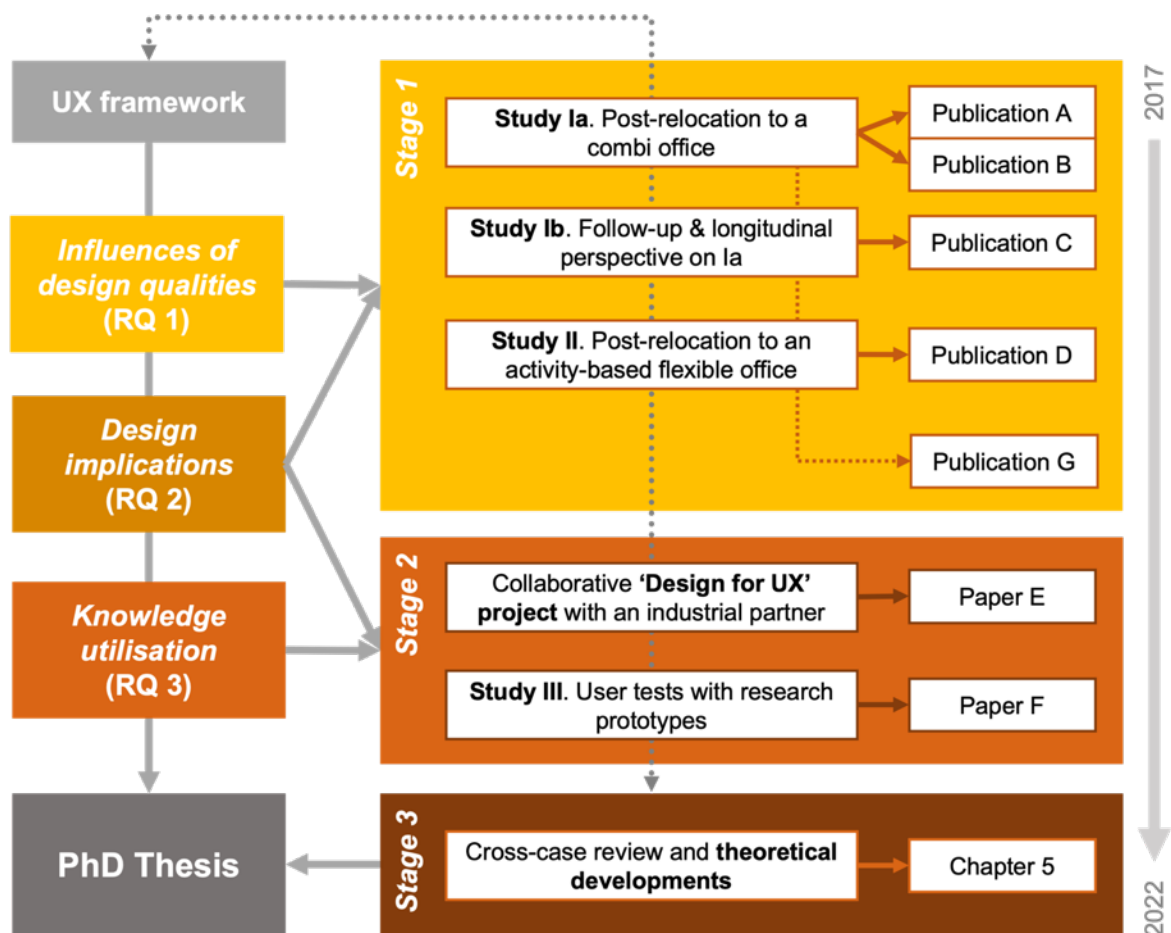


Figure 7. Relationships between research work, research questions, and the thesis.





4. Findings

This chapter gathers the contributions of each of the research activities introduced in the previous chapter to answer the research questions formulated in this thesis. Rather than a summary of findings of such activities separately, the findings are interpreted together and presented question by question.

Overall, the studies show that user experiences with flexible offices are often influenced by interrelated design qualities of the spaces and artefacts in use, rather than isolated qualities. Thus, this chapter does not attempt to report on a list with every single quality identified in the studies (the appended publications can provide more detail in this regard). Instead, it provides insights on a more macro level focusing on the most important qualities across cases, how these relate, and their design implications on an experiential level. Design qualities are understood in this thesis as tangible and intangible properties defining the nature of something, for example the aesthetic of a space or the shared quality of workstations, and can stand for multiple sensorial, pragmatic, hedonic, social and/or symbolic values. In accordance with the framework of the thesis, the findings are expressed in terms of users' appraisals of the qualities and feelings leading to positive or negative experiential outcomes, as well as their eventual responses.

The findings on design opportunities for positive user experiences with flexible offices are based on the main outcomes from the collaborative design project with the furniture manufacturer and the user testing of research prototypes. Such outcomes illustrate the utilisation of the knowledge acquired to further gain new knowledge on the experiences of users and the necessary preconditions to be designed for such experiences to occur. In this regard, such findings relate to the influences of design qualities and their design implications but address broader and rather systemic matters.

4.1. Answering RQ 1 - The influence of design qualities

What design qualities of spaces and artefacts in flexible offices influence the user experience? How?

Studies Ia, Ib, and II (publications A to D), report on the influence that diverse design qualities of spaces and artefacts in flexible offices have on the experiences of users with their offices. These qualities identified across cases and their influence on the user experience are described below together with figures that visually illustrate the experiential process described in the text, followed by some reflections to conclude.

New offices and aesthetic of interiors

Studies Ia, Ib, and II involved two different office buildings to which the users were relocated. Both buildings were similar in the sense that they had atriums around which new/renovated office spaces were distributed, and windows faced both the outer facades and the atriums.

The first impression was mostly good for the users, who appraised positively the architectural design and aesthetic of the flexible offices (Figure 8). The new office type with different spaces for different activities and breaks, and the updated furnishing designs even produced a “wow” response from some users. Adjectives like fresh, bright, nice, or beautiful were common in the studies when describing the upgrades experienced compared to the pre-relocation situation. In fact, in study Ia, the new premises marked the difference between one user feeling the need to find a job somewhere else and applying for a permanent position in the organisation. However, the good first impressions can fade over time when users get used to the new premises or their daily experiences are influenced by changes made in the space to adapt to organisational needs. For example, in study Ib, the addition of bookshelves for storage or further desks to welcome more colleagues resulted in users perceiving the office as “messier” or less aesthetically pleasing.

The aesthetic quality of the spaces was also related to the fact that all or most of the spaces in flexible offices are shared, which usually limits the possibility to customise them. This was sometimes perceived as a threat to individual and group identities or resulted in offices whose aesthetic was experienced as rather generic and sterile. The shared nature of spaces required collective agreements such as clean desk policies³, and organisations usually discouraged the customisation of

³ Clean desk policies refer to rules intended to regulate the use of shared workstations. These mainly entail the need to clear a workstation of belongings after use and vacate the workstation if the user is planning to work somewhere else for a period of time (e.g., ≥1h). Consequently, workstations cannot be customised, and users must carry their belongings around.

spaces even in rooms shared by a stable group of users. Some users associated this with cleaner and more pleasurable designs and even acknowledged that they were pleased with colleagues not being able to customise the space as each one had a different taste. Nevertheless, study Ib shows that the lack of opportunity to personalise workspaces remained a negative issue in the long term (see an illustrative overview of these findings in Figure 9).



Figure 8. View from the reception of the office in study II. Picture by Felix Gerlach.

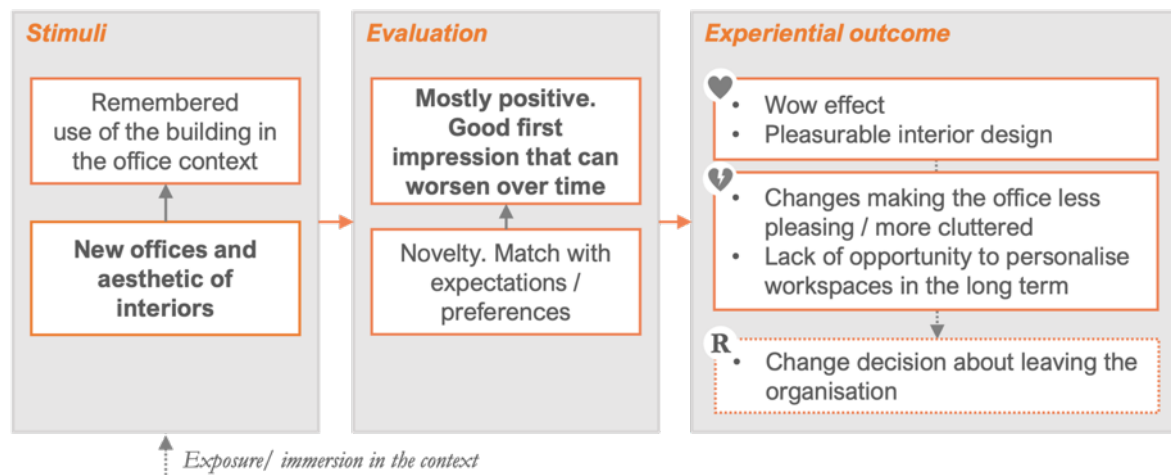


Figure 9. Illustrative overview of findings for the user experience with the flexible office in relation to “new offices and aesthetic of interiors”.

Diversity of spaces and functions

Together with the aesthetic of the offices, most users appraised positively the availability of diverse spaces for different activities and preferences in the immediate proximity, for example, different meeting rooms and spaces for breaks, quiet rooms or phone booths. The diversity of shared spaces usually resulted in access to different views and amenities, as well as pleasurable settings to socialise, relax, or work. This was experienced as something positive and often contributed to more social interaction, or at least, more interaction with colleagues from different units. However, the organisations often expected that the increased interaction would translate into increased collaboration, and this was not always the case. The interdependence and relatedness of users’ work topics and the share of individual versus group tasks were more relevant in this regard.

The diversity of spaces for a break was also coupled to positive experiential outcomes. In this case, the diversity implied other design qualities that influenced users’ experiences and were rather specific to each of the spaces. For example, in one office the in-house canteens were convenient and appreciated by the users, and the balconies with views, lounges with abundant daylight and a relaxing atmosphere or the furnishing aesthetics were experienced as pleasurable (Figure 10). The coffee corners evenly distributed in both offices facilitated encounters and social interaction. On the other hand, qualities specific to some of these spaces were negatively appraised by users in the studies. For example, in studies Ia and Ib the users felt that the lack of division-specific coffee spaces and the limited capacity of the existing ones ended up hindering the social dynamics within and between groups in the long term. In study II, the canteen was appraised as noisy and crowded during rush hours, while the coffee lounges open to the atriums of the building had the same issue with noise and were appraised as less convenient

for lunch due to limited equipment that did not help solve the crowding in the canteen. The users often related these spaces to positively experienced events such as coffee and lunch breaks with colleagues, which were happening regardless of the space itself.



Figure 10. An outdoor space for breaks in the office in studies Ia-b. Picture by Kalle Sanner.

Over time, spatial diversity remained a quality that was positively experienced, but the overall positive perception of this variety decreased in study Ib with respect to study Ia (two studies of the same office). The main reason was that the organisation transformed underused back-up spaces into standard desk areas that notably reduced the differentiation of spaces.



Figure 11. Example of a (big) meeting room for up to 16 users in studies Ia-b. Picture by Kalle Sanner.

Regarding diversity on the functional level, this was often related to the meeting rooms. The new offices had updated IT equipment that in the case of meeting rooms featured new teleconferencing devices, projectors, docking options, bigger screens and more. This equipment enriched the functions of meeting rooms, which were particularly appreciated as spaces for different types of encounters and discussions. In general, bigger meeting rooms were usually preferred because they were often available and appraised as more comfortable due to the extra space and larger work surfaces (Figure 11). Meeting rooms with teleconferencing functions offered additional opportunities for planned and spontaneous meetings, both in-person and with colleagues and externals in remote locations. This was appraised as meaningful by the users, who acknowledged the effects on reducing the need for travelling. However, a few limitations were also mentioned that negatively affected user experiences during meetings. In study Ia, for example, some meeting rooms were still lacking power outlets on the tables six months after relocation, and the available outlets on the walls were wrongly placed according to users. In study II, the big meeting rooms had double screens with different functions (video call and visualisation of documents) that impeded using both at the same time. This was experienced as inconvenient and meaningless.

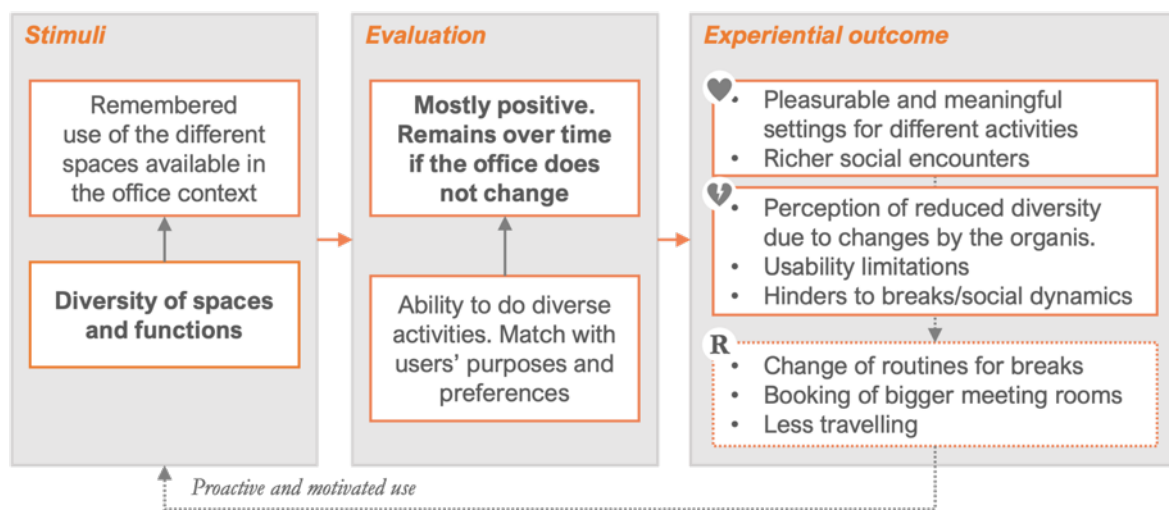


Figure 12. Illustrative overview of findings for the user experience with the flexible office in relation to 'diversity of spaces and functions'.

Openness vs. seclusion

Flexible offices have in many cases physically or visually open spaces that are shared with multiple users (Figure 13). This quality was identified in relation to both positive and negative experiential outcomes. For example, studies Ia, Ib, and II found that the visually open spaces resulted in more social interaction (mostly informal), better accessibility between office users as well as work units, and enhanced visual control of the surroundings.

However, this openness also made users feel overexposed to stimuli as the noise and movement by the workstations were perceived as higher. This negatively affected users' ability to avoid distractions, and sometimes resulted in tricky trade-offs, for example communication vs. concentration or privacy. When users relocated from cell offices to shared rooms or open zones, these negative experiences appeared more evident. The studies show that some users coped with this by using noise-cancelling headphones or working more often from home. Moreover, studies Ib and II indicate that the issues experienced with the openness do not resolve themselves over time and require intervention.



Figure 13. Examples of open spaces in study II. Picture by the author.

At the opposite end of the experiential spectrum were the secluded spaces for concentration and privacy. These were available in addition to the open-plan zones and were positively appraised. Secluded spaces were preferred for individual work, private communication, or relaxation, although there were important differences in their usage. In studies Ia and Ib the users had assigned desks in shared rooms and mostly preferred to remain at their desks despite occasional distractions; in study II, however, the smaller rooms were very popular and used as they allowed a similar experience to the one before relocating to the flexible office, in that the users could close the door for privacy and multi-task, switching between concentrative and interactive work, without being disturbed, disturbing others, or switching places (Figure 14).



Figure 14. Small quiet room in the office of studies Ia-b. Picture by the author.

The smaller rooms in the offices studied were usually designed with two workstations. However, user inquiries and observations confirmed that these were most often used by a single user. The main reason for this was that it felt awkward and/or rude for the users to use the second workstation if someone else was already inside.

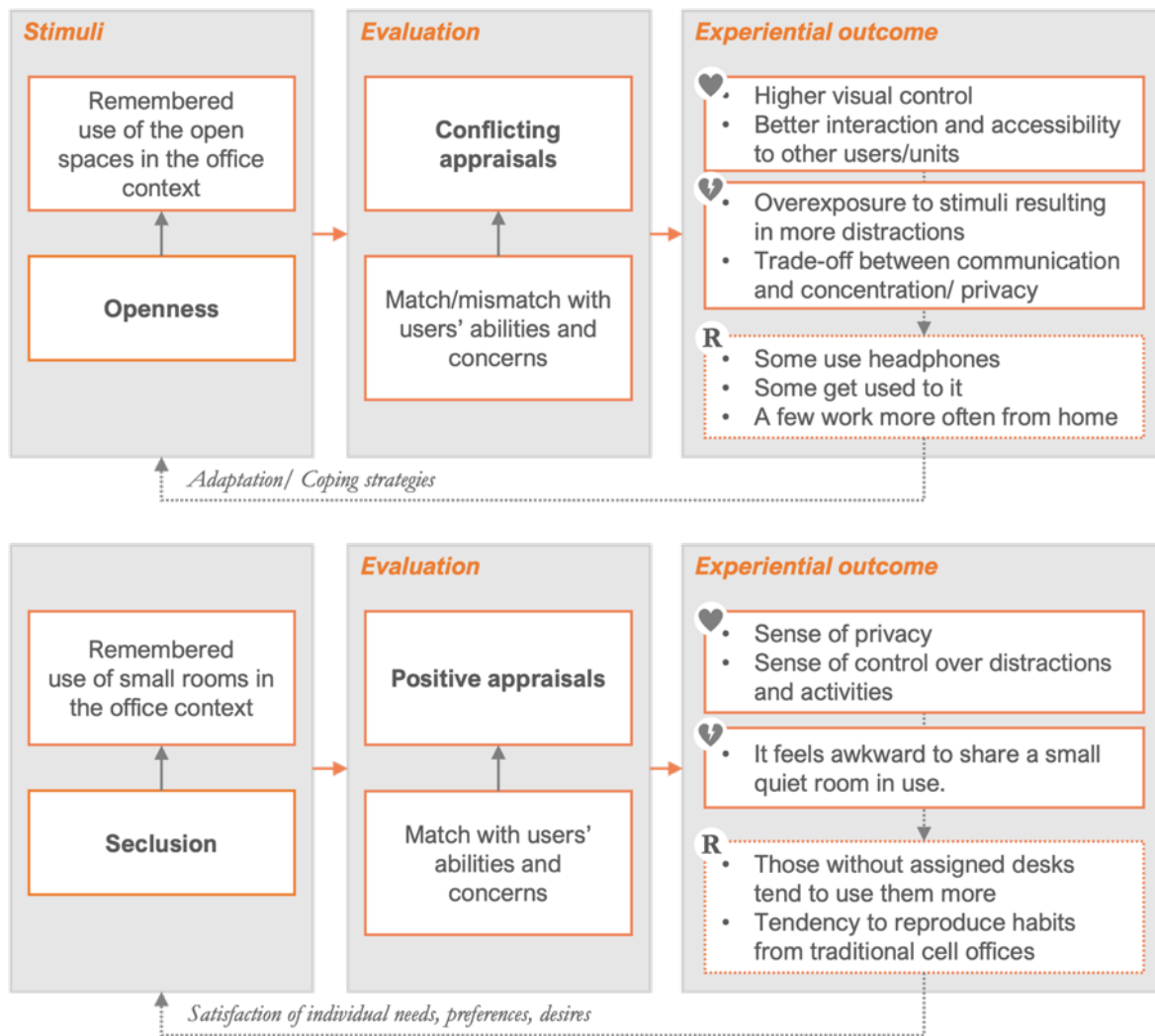


Figure 15. Illustrative overview of findings for the user experience with the flexible office in relation to 'openness vs seclusion'.

Flexible office spaces for flexible use

The intended flexible use of spaces impacted other aspects of users' experiences beyond perceptions and preferences. For example, the social dynamics changed due to more frequent encounters with more people in the organisation, but a few users also experienced alienation and anonymity due to colleagues being spread out within and outside the premises. In relation to the latter, the coffee and lunch routines of work units tend to disappear or become more unstructured.

Another change relating to this flexibility is that users feel the need to adopt new planning and work habits, particularly in cases without assigned desks. Users need to think in advance about what belongings they really need to carry around or what can stay in a locker, they must learn to work more digitally to avoid carrying around unnecessary papers, and they need to organise the tasks for the day in order to select a proper workstation or workstations.

The flexible use of spaces was also a reason for having different zones and rooms in the flexible offices. However, users often prioritised their own preferences over the activities at hand or the zone rules (Figure 16). In some cases, the design language of zones was very similar, making it harder to identify the intended use, or zones were not physically separated from each other, causing noise to spread and making the rules less likely to be followed. In study II, for example, both the preferences and the lack of divisions were identified as motives for the misuse of zones. The users related such misuse to feelings of inefficiency, exposure, and frequent dilemmas between preferred zones and zones compatible with their own activities. Moreover, quiet zones provided good support for individual concentrative work but were experienced as too silent by a minority of users, or unsuitable for those who preferred silence but had frequent calls. Altogether, these situations resulted in users experiencing poorer autonomy for use of the offices according to their own standards.



Figure 16. Zone labelling in the office of study II. Picture by the author.

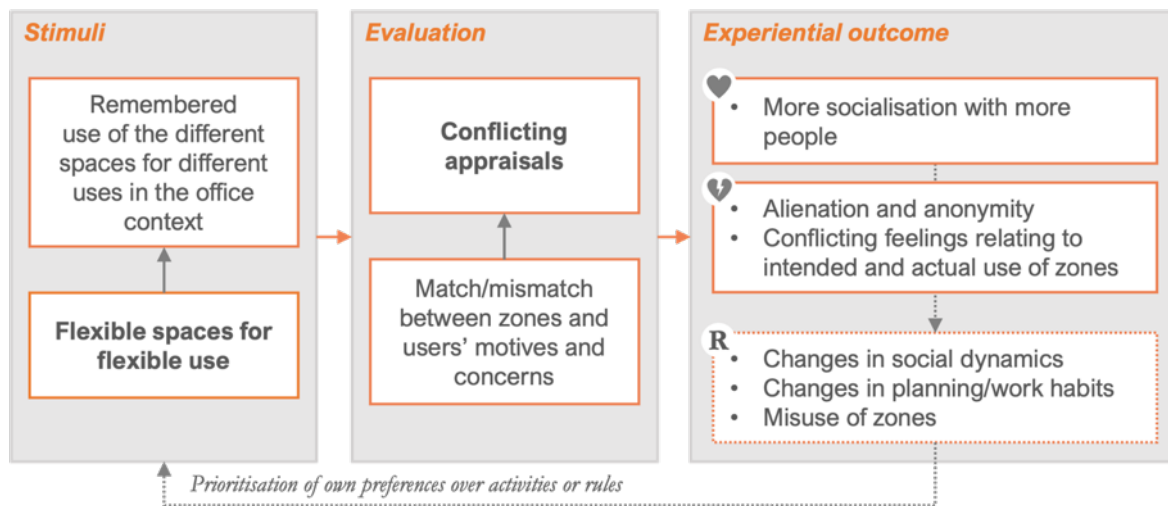


Figure 17. Illustrative overview of findings for the user experience with the flexible office in relation to 'flexible office spaces for flexible use'.

Shared vs. assigned

A majority of the users in studies Ia, Ib, and II appraised the flexible office positively, but the shared vs. assigned quality of workstations has been found to be crucial in the experience that users have with flexible offices across the studies. For example, in study II the workstations were shared but, in general, it was common for users not to switch workstations in the course of the day or to switch only if the activity at hand was not suitable for a chosen workstation, for instance a meeting. Motives for this were to stay in proximity to colleagues, individual preferences, job characteristics, or feelings of wasting productive time with the search, set up, and clearing of suitable workstations.

In the case of users who worked remotely a few days per week or travelled more often, desk-sharing was experienced and adopted with ease, as having an assigned but empty workstation made less sense to them. Being able to choose workstation was also positively appraised.

Those who worked every day at the flexible office found it more stressful not knowing if they would manage to have the preferred settings and tended to reproduce nesting habits from traditional office environments. This implied that the users claimed their favourite workstations by arriving early and/or choosing the same desk/space/territory on consecutive days. In the long term, it was common that such nesting habits became non-written rules for the groups, meaning that some users appropriated certain workstations and other users avoided using those workstations as they 'belonged' to someone else.



Figure 18. (Top) standard office room vs. (bottom) quiet room in the office of studies Ia-b. Pictures by the author.

In studies Ia and Ib, the flexible office had assigned workstations in rooms shared by two, six or eight users. The workstations were equipped with height-adjustable desks, double screens, and everything else the users needed, including noise-cancelling headphones supplied by the organisation. This made it convenient for users to remain at their workstations regardless of the task and contributed to explaining why their office rooms were the favourite places of the office for most users. A side-effect of this was that the back-up spaces (other than meeting rooms) were underused. Moreover, the equipment in back-up spaces such as quiet rooms did not represent enough advantages (e.g., regarding comfort, equipment, privacy) and in addition these spaces were not bookable (Figure 18). Thus, despite the positive evaluation of the variety of spaces, a majority perceived switching between spaces as a bigger burden than remaining at a preferred workstation and dealing with occasional distractions.

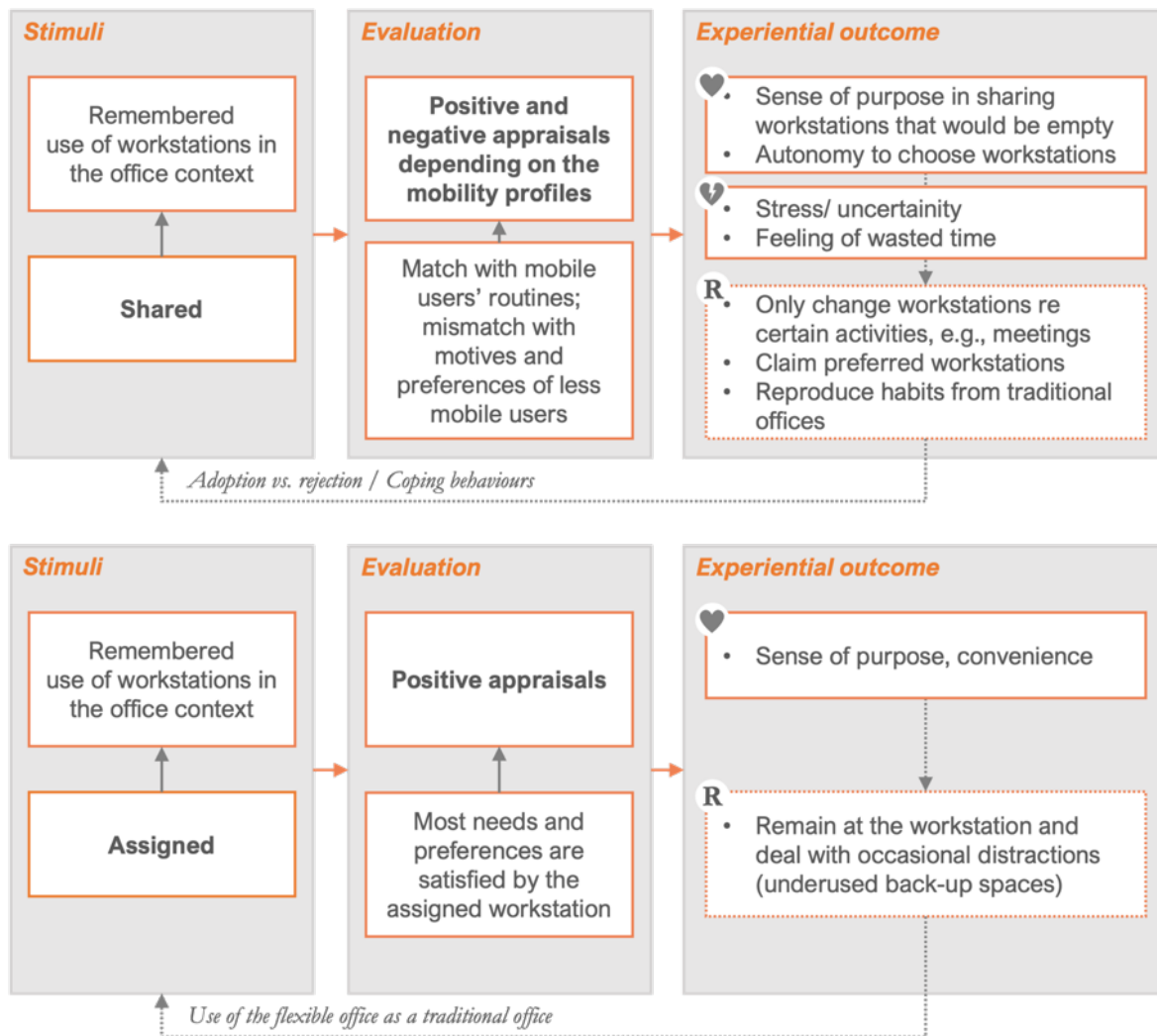


Figure 19. Illustrative overview of findings for the user experience with the flexible office in relation to 'shared vs assigned'.

Ergonomics of furniture and accessories

The user experience of furniture ergonomics varied between cases in relation to the assigned or shared quality of workstations. When the workstations were assigned, the users managed to find comfortable postures and appreciated the adjustments and quality of the furniture; when all the work settings, including standard workstations, were shared, some users reported negative experiences of control over the adjustments of the different chair models, or the limited availability of the favourite type of chair (Figure 20). The users had to adjust workstations before use, which was one more reason not to switch workstations, and it was not always obvious to them how to operate the various adjustment mechanisms.



Figure 20. A user leaves a note on a shared chair asking not to change the adjustments (study II). Picture by the author.

In study II, several users also reported a negative ergonomic experience with the choice of chairs, non-height-adjustable tables, and distance to big screens fixed on the wall for teleconferencing, resulting in uncomfortable postures unsuitable for long sessions (Figure 21).



Figure 21. Example of teleconferencing room in study II. Picture by the author.

Relocating to a flexible office usually implied that users' physical storage was reduced to a locker and that they had to adapt to a more digital and paperless way of working. Users often commented on this as a limitation after relocation, but

they seemed to adapt to this change over time. In the long term, only a minority continued mentioning this as an issue in study Ib, while in study II the issues related more to the need for storage of a work unit than to personal storage.

The organisations responsible for the offices provided ergonomic accessories to users with special ergonomic needs such as those with chronic strains on the wrists and forearms. This made the office to be experienced as more pleasurable. In study II, for example, several users were observed to make use of a desk extension or a RollerMouse. The ergonomic accessories were shared but were numerous and varied in design. This was positively appraised by the users (Figure 22).



Figure 22. Workstation in use with ergonomic accessories in study II. Picture by the author.

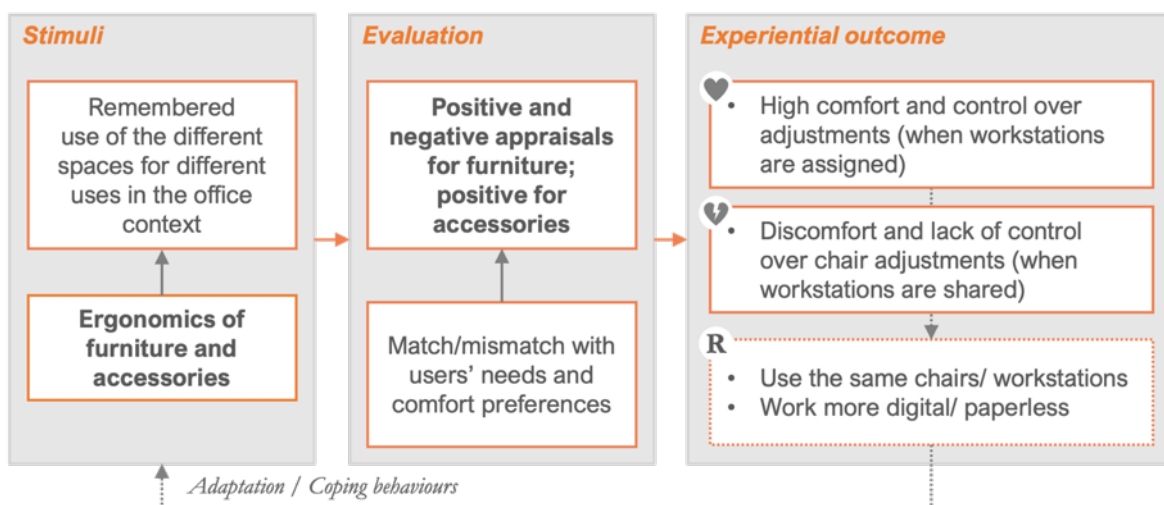


Figure 23. Illustrative overview of findings for the user experience with the flexible office in relation to 'ergonomics of furniture and accessories'.

Automated systems

In studies Ia and Ib, the office relocation entailed a notable improvement in terms of access to views, daylight, and how bright the spaces were. However, the offices studied had automated climate and lighting systems with limited or no possibility for the users to exert control. The erratic functioning of automated blinds affected the long-term experience of daylight in study Ib, which had been experienced as very positive in study Ia, and made evident the experience of lacking control over the environment. In study II, a few users commented on the impossibility to match lighting preferences at the workstations, as the only control was on a room level and individual preferences could not be catered for.

Regarding the automated climate systems, the users (more than half in studies Ia and Ib; fewer in study II) experienced little control over diverse discomfort issues with, for example, too cold or varying room temperature, dry air, or poor ventilation that was more noticeable in smaller rooms. Users who commented on this often had negative opinions and reported on coping strategies such as wearing an extra top layer to feel less cold or avoiding certain rooms.

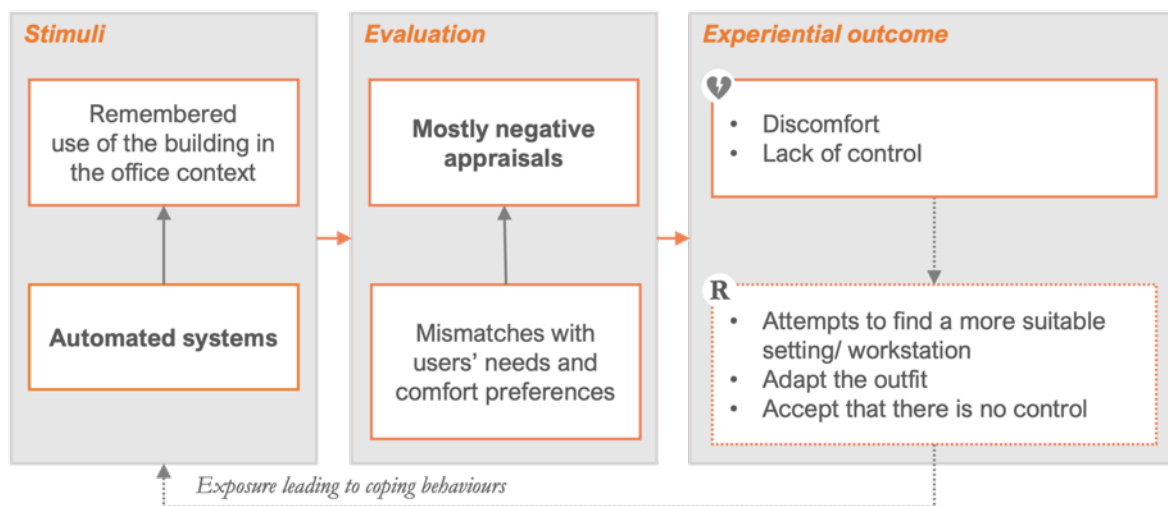


Figure 24. Illustrative overview of findings for the user experience with the flexible office in relation to 'automated systems'.

Qualities explaining underused settings

Most of the soft seating areas (Figure 25) in studies Ia, Ib and II were appraised as attractive but impractical for work tasks beyond reading. Indeed, the soft seating areas in open spaces were perceived as transit areas to other zones and rooms. The small table surfaces to accommodate belongings and documents, the postures, and the fact that standard workstations were more ergonomic and suitable for more tasks were key motives for such appraisals. Consequently, most of the sofas, armchairs, and stools in the work zones of the offices studied were seldom or never used.



Figure 25. Example of space that was observed to be underused in study II. Picture by Felix Gerlach.

The phone booths were also observed to remain underused. The availability of other back-up spaces such as meeting rooms or small quiet rooms was appreciated and they were preferred over phone booths for phone calls. The booths essentially were tiny spaces, either with no windows or completely exposed through glass walls. In study II, users frequently handled phone calls by the workstations in interactive and semi-quiet zones for their own convenience, eliminating the need to switch places and carry belongings. In study II, some of the meeting rooms on the lower floors were pay-per-use, which was appraised as a burden for the budgets of the work units. Hence, most of the pay-per-use rooms remained empty, and the users responded with higher demand for the ‘cost-free’ meeting rooms.

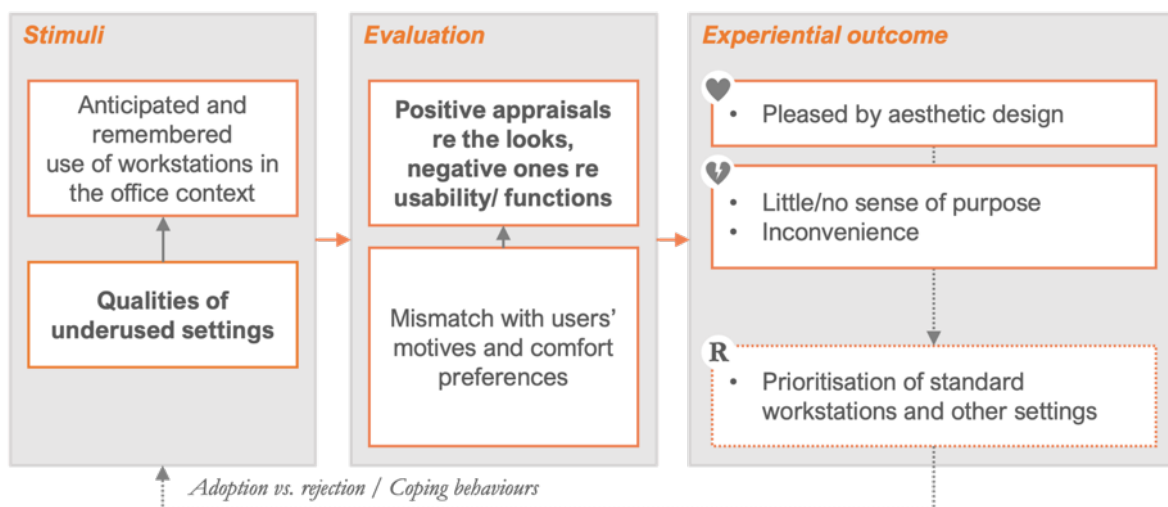


Figure 26. Illustrative overview of findings for the user experience with the flexible office in relation to ‘qualities of underused settings’.

Reflections on the influences of design qualities

The design qualities of the artefacts and spaces in the flexible office are experienced in ways that require analyses on different levels of abstraction to better understand their influences. For example, a negative experiential outcome with the adjustment mechanisms of a chair can relate to a usability problem of a specific chair model that requires ‘zooming in’ into this specific issue. However, the very same chair can elicit opposite experiential outcomes if it is assigned or shared, in other words adjusted once by one user (chair experienced as comfortable) vs once every time the chair is used (experienced as uncomfortable/inconvenient). This requires ‘zooming out’ and study of the interrelations of different qualities on a more systemic level.

Flexible offices are multi-user and multi-touchpoint environments, meaning that even if experiences are subjective, these are not necessarily individual or easily explained in relation to one artefact or space. User experiences can relate to one or more ‘things’ and one or more users depending on the situation. Users can have positive and negative experiences simultaneously, and this can trigger responses that in theory appear counterintuitive, for example, sitting in an open space and coping with more frequent distractions instead of moving to a quiet room, in order to stay in the proximity of certain colleagues.

Offices are defined by rich constellations of artefacts and spaces, used by users with different purposes, needs, and preferences, that showcase how complex flexible offices are as a ‘UX system’ to study. In this regard, the shared quality of spaces and artefacts seems to add an extra layer of complexity. Moreover, design qualities such as the openness of spaces can have the (sometimes conflicting) duality of eliciting both positive and negative experiences. For example, better visual control and social connection in open spaces vs worse control over distractions and privacy. Moreover, the positive appraisal of the diversity of settings offered by flexible offices somehow conflicted with the findings of certain settings remaining underused due to contextual matters such as the preference for multitasking settings, or the office used before relocation.

All this suggest that designing flexible offices is more difficult than designing traditional cell or open-plan offices, as there are additional decisions and design qualities relating to the mix of settings that only exist in this office type. Similarly, the findings emphasise the flexibility of the UX lens adopted, which allowed zooming into details and zooming out to capture systemic issues.

4.2. Answering RQ 2 – Design implications to consider

What design implications are there to consider for improving the user experience with flexible offices?

Studies Ia, Ib, and II (publications A to D) partly discuss the design implications derived from identified experiential outcomes with flexible offices. The collaborative ‘design for UX’ project and study III (publications E and F) elaborate further on such implications. Accordingly, the findings and discussions across cases have been reviewed and design implications have been drawn. Given that these implications derive from experiential outcomes, I have structured the answer by experiential outcomes as themes that I reflect upon. For each of the themes, a visual representation is provided that complements the text and illustrates how my reflection connects design qualities, experiential outcomes, and design implications to consider. The themes are:

- (i) Experience of community,
- (ii) Experience of autonomy,
- (iii) Experience of purpose,
- (iv) Experience of control over the environment, and
- (v) Experience of pleasure (affects and satisfaction).

Contextual aspects were also identified in the studies that played a role in the experiences of users and have been considered in the answer to this research question. For example, the office type and conditions that users had before relocating to a flexible office, managerial decisions for the planning or changes in the office, the extent to which office relocation processes were participated by the users, rules on the use of spaces, and differences in job profiles.

Experience of community

Relocating from a traditional to a flexible office brings changes to the social dynamics of individuals and groups. The users in studies Ia, Ib, and II often reported they were more exposed to social encounters with colleagues from different work units, but at the same time, the routines and sense of belonging within their work unit could get diluted into the organisation’s bigger group. Furthermore, some users experienced anonymity when sitting with unfamiliar colleagues or when the colleagues in their work unit were in remote locations. Indeed, some of the users in study III appraised the possibility of working secluded with the prototype as negative, precisely due to their socialising/interaction needs and habits.

These situations together with the lack of opportunities to settle and/or customise spaces have been identified as potential identity threats for both individuals and

groups. Thus, proposals to improve the experience of community in flexible offices should consider strategies to (re)build a sense of belonging at different levels and make the increased number of encounters more meaningful, not just more in number. In this sense, scheduled events and protocols can complement the design of spaces and artefacts for interaction. A key point here is that users should not have to figure out how to solve their social needs entirely by themselves.



Figure 27. Illustration of how design qualities/context, experience of community, and design implications are connected on a reflective level.

Experience of autonomy

There were situations identified in the studies that affected the users' autonomy, by making it more difficult to act and make decisions according to own standards while dealing with the socio-organisational context, for example, in relation to how or where to conduct different activities.

According to users in all the studies conducted, the unclarity or non-existence of behavioural rules was recurrent, and in some cases rules were adopted informally in smaller groups such as a shared room or zone. The latter was more frequent in zones or rooms with assigned workstations. There were instances of zones being poorly defined that led to their misuse, difficult indoor navigation, and poorly separated spaces that made it harder to avoid noise spreading from the more interactive zones to the quieter zones. There was also the case in which users felt the need to compete for certain workstations and remained there to avoid 'losing' a preferred spot. Moreover, the non-written codes of conduct or the need to belong to a group resulted in additional challenges from the social context that impacted users' routines. For example, users who felt that leaving a group to work in a different zone will make them an outcast or raise questions among colleagues; or users who decide not to share a small quiet room when there is someone else there to avoid feeling awkward or impolite.

Contextual aspects such as the organisational and working cultures had additional implications for the users' autonomy, both relating to the flexible way of working and to particularities of the premises and the organisation. For example, in study Ia, the office was originally planned as an accessible space for people outside the

office to come and collaborate with those working in the office, but stolen IT equipment required the organisation to change plans and restrict access. In study Ib the long-term absence of behavioural rules and conflicting interpretations of individual responsibilities deteriorated the appraisal of certain spaces such as the lunch lounge or the attitude towards colleagues. In study II, the decision to allocate lower floors for pay-per-use conference rooms had consequences on the rest of the office building; the cost was an extra burden for the budget of most workgroups and produced higher occupancy in the free-of-charge rooms.

Therefore, it may help to move away incompatible zones that are next to each other, create partitions, adjust ratios of users per desk, anticipate conflicts between the conceptualised office and the daily reality (context) of the users who will use it, or complement the office design with unambiguous and clearly communicated rules. Further, it is important that the design cues of spaces and artefacts express a properly differentiated message on intended use for each of the zones or rooms. For example, these design cues were considered for the prototype tested in study III, whose design was intended, among other aspects, to clearly communicate a “do not disturb” message to surrounding co-workers. In addition, during the tests, there were always two units of the prototype to create a sense of mini back-up space for concentration, and avoid it being perceived as an anomaly in the office.

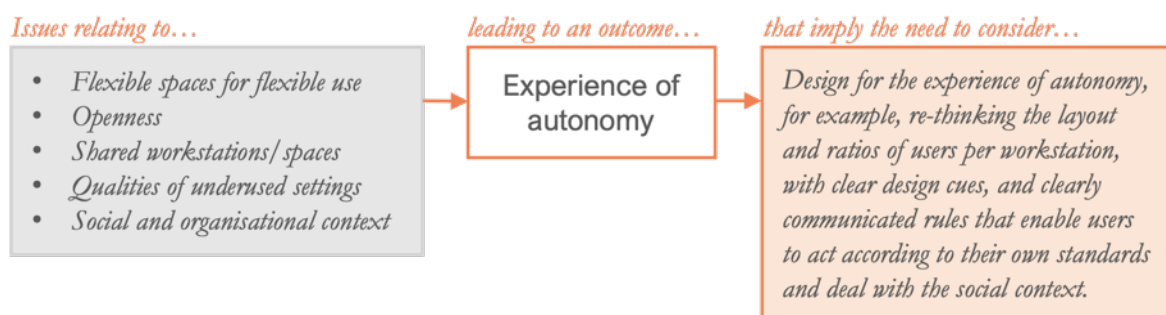


Figure 28. Illustration of how design qualities/context, experience of autonomy, and design implications are connected on a reflective level.

Experience of purpose

The findings in study II indicate that compliance with the desk sharing policies was overall low. One of the main reasons for this was the mismatch between the shared quality of workstations and the users’ goals and preferences, for example the case of users who prefer to stay close to colleagues and cope with occasional distractions, although this behaviour was also observed in the cases of assigned desks in shared rooms. Coherent with this are the use, underuse and misuse of facilities observed in the different studies; if the spaces or artefacts are anticipated or perceived as lacking distinct advantages the users will have little or no motives

to use them. In this regard, pragmatic design qualities such as the size of desk surface, or hedonic qualities such as the ergonomics of a chair, are key.

The post-relocation evaluations are valuable opportunities to verify the extent to which the office spaces and artefacts support users' purposes and why (or why not). For example, the work areas/rooms with sofas in studies Ia, Ib, and II were barely used or not used at all. The fact that the offices were flexible did not automatically result in users using all the back-up spaces. Indeed, desk areas/rooms, meeting rooms and spaces for breaks covered most needs for the users in studies Ia and Ib, in the same way that such spaces did before the advent of the flexible offices. Re-thinking these spaces and the artefacts therein can increase their utilisation, although what is purposeful in each case may vary substantially; in study II replacing these sofas with more workstations could be the solution, while in study Ia the users had proposals to repurpose underused spaces as a different type of back-up space, such as a library, a creative room, a room for light workout/stretching, and so on.

Therefore, contributing to a more positive experience of purpose requires a rich understanding of users' motives and activities in context, as well as the spaces and artefacts that enable fulfilling them. In particular, the difference in users' activity profiles was a contextual aspect that appeared relevant in all the studies and that would require different design strategies. For example, study III compared the experiences of users in two offices with very different activity profiles – mostly individual and stationary work vs. mostly interactive and mobile work; this largely explained the need or not for a furniture concept like the one prototyped and tested. Moreover, this substantiates the reason why flexible offices cannot be constrained to the homogeneous spatial definitions of traditional offices; rather, each flexible office is and should be unique.

The relocation processes were another contextual factor that also impacted the experience of purpose, and to some extent their autonomy too. For example, the low participation of the organisations' employees as users of the new office in studies Ia and Ib contributed to understanding the discrepancies observed between the intended and actual levels of collaboration, or the intended and actual use of back-up spaces. Moreover, the experiences of users in study Ib had deteriorated over time concerning changes decided on a managerial level, such as replacing underused back-up spaces with more workstations instead of following users' suggestions. In relation to the latter, the overall low occupancy of the office in study Ia partly prevented downsides such as exposure to visual and auditory stimuli from becoming critical issues. Thus, repurposing back-up spaces to increase the office density may result in undesired side-effects.

In the case of the furniture concept prototyped for and tested in study III, it was expected that not all users would find it purposeful because of the different activity profiles and organisational contexts where it would be tested. For example, users with very heterogeneous and interactive work routines would not benefit as much from using an artefact that facilitates individual and focused work. The concept was deliberately designed to provide the preconditions for a particular experience that would not be needed or desired by all users, although it represents one more meaningful option of a back-up setting in a flexible office environment.

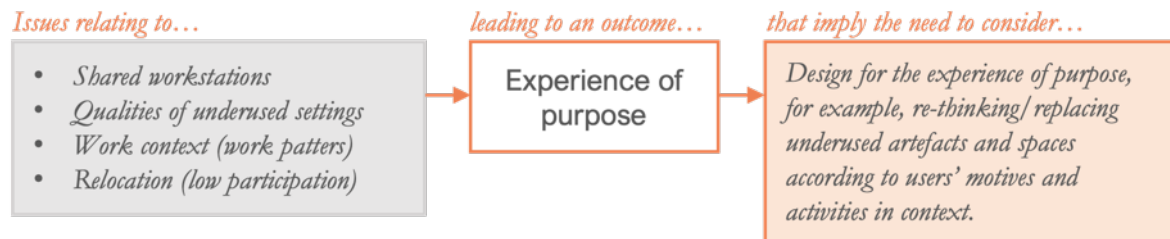


Figure 29. Illustration of how design qualities/context, experience of purpose, and design implications are connected on a reflective level.

Experience of control over the environment

All the studies show that the availability of different spaces for different activities is experienced very positively by the users. Enabling options is important for them to manage and adapt the immediate office environment to their needs, preferences, and so on. In this regard, the furniture concept prototyped and tested in study III aimed at providing a new experience of control in the office by creating a sense of shielded space within the open-plan space. There are products on the market such as booths or noise-cancelling headphones that already propose similar experiences but use different design strategies and consequently have different implications for the experiences of users. The results of the tests in study III provide valuable insights on how such a concept expands users' options of control, together with insights on how to develop it further.

The lack of control is evident in relation to the automated systems for climate and lighting in studies Ia, Ib, and II, which left little or no margin for the users to make adjustments on an individual or group level. However, there were also situations in which having the choice was counterproductive or was not enough. This was the case in study II, where the diversity of office chairs provided resulted in a cumbersome situation for some users, who struggled to operate the numerous and dissimilar furniture adjustments on a daily basis. Some users suggested having less diversity of chairs but this does not resolve eventual usability issues. Furthermore, there were no differences between office chairs for individual or shared use across the studies. Hence, furniture designs for sharing in flexible offices should be optimised for multi-user handling.

The type of office that the users have previously worked in was a contextual factor common to all the studies that also related to the experience of control. Previous experiences with different office designs set different expectations and concerns regarding the relocation to a flexible office environment. For example, users tend to feel more exposed to distractions when relocating from individual cell offices, while earlier studies show that users relocating from open-plan offices appreciate the possibility to withdraw to a secluded quiet space (e.g., van der Voordt, 2004). Thus, this contextual factor should be considered for the management of relocation processes and interventions for incremental office improvements.



Figure 30. Illustration of how design qualities/context, experience of control over the environment, and design implications are connected on a reflective level.

Experience of pleasure (affects & satisfaction)

Many user appraisals of the spaces and artefacts in the flexible offices studied related to hedonic aspects of the experience (i.e., affective responses and satisfaction). For example, the architecture and furnishing design, the access to views or daylight, the indoor climate (dis)comfort, the diversity of spaces, and ergonomics of furniture. In this regard, it seems obvious that aesthetically attractive and comfortable artefacts and spaces were preferred to unattractive and uncomfortable ones. However, it is less obvious that the mediation of certain design qualities in the workplace experience could lead users to feel the need to quit a job or feel motivated and energetic. The comprehensive upgrade of facilities in study Ia, resulted in a flexible office that was overall experienced as more pleasurable than the cell offices prior to the relocation.

Likewise, users often referred to experiences that were pleasurable (or not) in relation to how meaningful artefacts or spaces were, for example in facilitating social or work interaction. In this sense, users' experiential outcomes involved multiple feelings and responses regarding the spaces and artefacts in use. This became first evident when analysing the experience of users in study Ia from a well-being angle; affects and satisfaction mirrored the positive and negative influences of design qualities on eudaimonic aspects (i.e., meaningfulness) of experiences beyond the hedonic ones. Nevertheless, the same analysis suggested that meaningful experiences may not necessarily be pleasurable. Therefore,

improving the experience of pleasure with flexible offices does not lie only in the hedonic design qualities of artefacts and spaces, but also in how these qualities support users' purposes, autonomy, control, and so on. The development and test of the furniture concept (Design for UX project & study III) exemplify this reasoning; the primary design qualities were oriented to enable control over sound stimuli, but the artefact itself had other pragmatic, hedonic, symbolic, and sensorial qualities that further influenced the experience with the prototype and required consideration.



Figure 31. Illustration of how design qualities/context, experience of pleasure, and design implications are connected on a reflective level.

4.3. Answering RQ 3 – Learning from knowledge utilisation

How (if possible) can one design for positive user experiences with flexible offices?

The collaborative Design for UX (DfUX) project with a furniture manufacturer and study III (publications E and F) are the latter research activities of my doctoral studies and together constitute a Research through Design (RtD) project. As part of the RtD project the knowledge acquired from previous research activities was utilised to explore design opportunities for positive user experiences with flexible offices. This ambition to utilise knowledge is inherent in my design background and the user-centred design perspective in which this thesis is anchored. However, my ambition was not about designing in the traditional problem-solving fashion of the design practice. Instead, I wanted to gain further insights into user experiences with flexible office artefacts and spaces and learn how to design for positive user experiences to occur. Hence, the RtD approach.

The learnings and reflections from both the explorative process and its outcomes provide the answer to research question 3. Accordingly, the answer is structured on learnings about (i) key aspects, decisions, and challenges of the process, and (ii) outcomes of designing for positive user experiences with flexible offices.

Keys aspects, decisions, and challenges of the process

The first and most important aspect of the process is that the exploration of design opportunities was not about designing 'something' but designing for a user

experience. Designing for experiences requires setting an experiential goal, for example an optimal experience that represents the opposite of a suboptimal experience, redefines the course of an experience, or fills an experiential gap. The main implication of this is that an experiential goal does not specify the solution. Will it be a product, a service, a protocol, or a combination of these? In this sense, it is like reversing a traditional design process; instead of ideating concepts for a solution, for instance a new ergonomic chair, the first step is to discuss strategies for how to deliver the proposed experience, for instance the users should feel 'X' and 'Y'. This way, the creative process is not constrained by a single solution (the chair); the solution space is virtually infinite. Once the strategies for delivering the experience are defined, one can begin to explore and assess different types of solutions that align with the strategies, for instance whether it should be a new seating artefact or something else. Only after deciding on a type of solution are conceptual designs materialising such a solution ideated, discussed, and screened, before one is finally chosen.

A key decision of the process concerned how to explore design opportunities. This relates to the need to act beyond knowledge dissemination highlighted in the introduction, to the practical implications discussed in the appended publications regarding the different stakeholders involved in the office field, and also to the interview with the architect responsible for the renovated office study Ia. The insights from the architect exemplified the limited interaction that existed between research and practice and, according to her, it was not an isolated case but a standard practice in office planning and development. Collaboration is critical in a field with numerous stakeholders whose interests may not be aligned between the stakeholders or with those of the users. Therefore, I devoted extra efforts to realising the collaborative DfUX project with the furniture manufacturer. This was highly relevant, as furniture manufacturers are a central actor in the office field and the design practice. They produce many of the kinds of artefacts and spaces that mediated the experiences of users with flexible offices in my studies. Having said that, the numerous stakeholders in the office planning, development, and operation would have made possible numerous other collaborations, for example with architects, building engineers, IT technicians, facility managers, ergonomists, procurers, maintenance staff and so on. In this case, the main implication of collaborating with the furniture manufacturer was that the solution space to be explored with the experiential approach was limited to office furniture. The exploration was further narrowed down with the experiential goal set for the collaboration: to enable a positive user experience of control over sound stimuli and related distractions. The collaborative DfUX project culminated with a prototype of an office furniture concept (see publication E for more details).

The testing of an eventual solution was an additional key aspect of the process. Generally, pursuing solutions to problems in the design discipline requires exploring the solution space and testing before communicating the final solution (Cross, 1990). The findings reported overall denote the contextual and systemic nature of experiences with flexible offices. Changes in one artefact or space may have ramified effects on the user experience with the office, for example adding bookshelves for storage that resulted in an overall less pleasurable aesthetic of the interior. In this thesis, the testing was further justified by (i) the complexity of designing flexible offices, (ii) the relatively unpredictable results of a design intervention, and (iii) the RtD process in which subsequent prototype versions are tested and redesigned in the exploration of solutions.

There were a couple of decisions that had some implications for the process. First, the furniture manufacturer and I agreed to build a ‘minimum viable product’ (MVP) to collect realistic feedback from the users. MVPs are high-fidelity prototypes with enough features to allow users to experience the equivalent of a finished product. This decision implied a higher investment of time and material resources at the expense of a fewer number of tests, but it enabled evaluating user experiences equivalent to those with actual products. Second, installing a single unit of the prototype in the office space could easily be perceived as an anomaly by the users. Therefore, I proposed to build two units with two objectives: (i) create a sense of a mini-zone with a particular function, and (ii) test different sensorial experiences with two units that look identical but had different structural and acoustic materials. Both were tested in a lab (Figure 32) taking as a reference ISO DIS 23351-1 to anticipate whether the feedback from users was (partly) based on an actual acoustic effect or a psychological effect (only). The lab results showed similar acoustic performance and the users barely noticed any difference during the tests. This suggests that (i) the margin to influence auditory perceptions with semi-open furniture ensembles was rather limited, and (ii) the acoustic properties of office spaces may have mitigated constructive differences.



Figure 32. First version of the prototype during the lab test.

The biggest challenge for the testing was the pandemic context. Offices have remained empty for almost half of my doctoral studies. By the time the first prototype was ready (August 2021) the local restrictions were about to be lifted, but there remained considerable uncertainty on how long this new situation would last. This meant that neither of the two offices where the prototypes were tested could be studied in advance. A deeper understanding of their contextual situation was gained in parallel to the tests. The criteria for choosing these offices were mostly limited to their flexible nature and their availability for the study. It was otherwise extremely difficult to test the prototypes in realistic conditions. An overview of the stages in the RtD project is displayed in Figure 33.

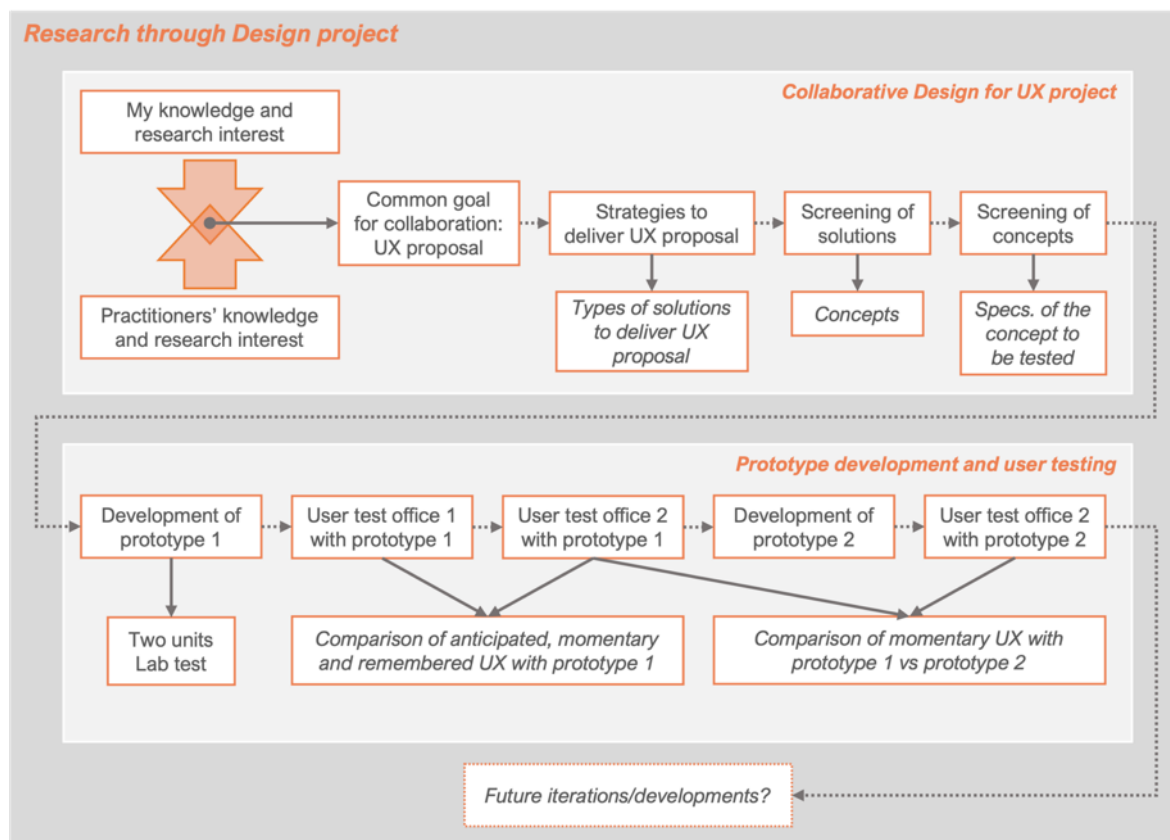


Figure 33. Overview of the RtD project

As a token of gratitude and a means to collect additional feedback, the results of the complete RtD process were presented to three of the representatives (R1, R2 & R3) from the furniture manufacturer who participated in the project. Their main observations related to the experiential approach, as it was challenging but interesting and different to their traditional problem-solving approach: *‘you have to make huge decisions quickly at the beginning that affect the complete process [...] we usually have more development loops, especially when working on a conceptual level [...] It could have looked like something completely different in the end’* (R2). The time constraint was the biggest challenge, *‘I felt that we were short on time to do more things together, although time is always critical in our processes’* (R1). In addition, mixing knowledge and

competencies in the decisions was positive: *“this shows that it is good to have people who are not familiar with product development asking the ‘stupid questions’ because these can be very important [...] After all, we produce furniture for ordinary people”* (R3). The process made them reflect from a new angle: *“the user experience is considered in our processes, but we don’t base new developments on it. This is something that I will bring to other processes”* (R2).

Due to the pandemic situation, some of the sessions planned were conducted online. The overall result was positive: *“the online sessions were fun [...] and useful to integrate the perspectives of more people [...] we should do that more”* (R1). However, the difficulties in having spontaneous and deeper discussions made on-site workshops preferable: *“the digital workshops worked really well, but I feel that I get more out of the session when it is physical [...] and I tend to remember more afterwards”* (R3). Also: *“we achieved more during physical meetings, but all the sessions were well prepared and I felt safe about the process despite not being in control”* (R2).

Finally, the decision to test two units of the first prototype for different sensorial experiences was an interesting idea because *“we would have not done that otherwise, and now we have that [knowledge] as well”* (R1). This feedback from the furniture manufacturer has been relevant to understanding the benefits and learnings of the collaboration for both ends and showcases the potential gains for similar processes in the future.

Outcomes of designing for positive user experiences

User involvement in different stages of a design process is a central aspect of the design practice and designing for user experiences is no exception. In this case, the design process departed from knowledge acquired with office user studies and ended with the tests of the research prototypes in two offices, one of an IT company and the other of a real estate company. Thus, user involvement has been fundamental for a number of learning outcomes.

One of the learning outcomes of involving users in the tests resulted from the confrontation of expectations, perceptions during use, and memories of use. For example, during the tests with the first prototype, the experience that the users in the IT office anticipated was worse than what they experienced during and after the use. In the case of the real estate office, the responses became more neutral during and after use, although their overall impressions were more negative. This was related to their interpretation of the furniture concept based on pictures of the research prototype. In this sense, the representation of a product and the first impression that it caused played an important role in users’ judgements and predisposition to use it. Further, the overall results show that the design concept created expectations of a noise-cancelling effect for several users that did not correspond to the perceived acoustic performance. This negatively affected their

perceived control over sound stimuli. On the other hand, the effect on the experience of control over privacy, visual distractions, and (to a lesser extent) work tasks was noticeable and more positive. These results highlight the relevance of designing for what users anticipate of an artefact, as well as the matches or mismatches with its actual qualities or performance.

The users from both offices had numerous suggestions to improve the first version of the prototype that often related to aesthetic and ergonomic design qualities, for example making the design rounder, more appealing, lighter, compact, and open. In this sense, the priorities for the development of the second prototype had to change to emphasise other qualities beyond the acoustics; increasing the level of seclusion, adding acoustic material, or active noise-cancelling features were not feasible options at this point.



Figure 34. The first (left) and second prototype (right) installed in the real estate office.

The second prototype obtained better results in almost every respect, and it was appraised as meaningful (Figure 35). Thus, reacting to users' feedback produced relevant results, even when the achieved effect was not the originally intended one.

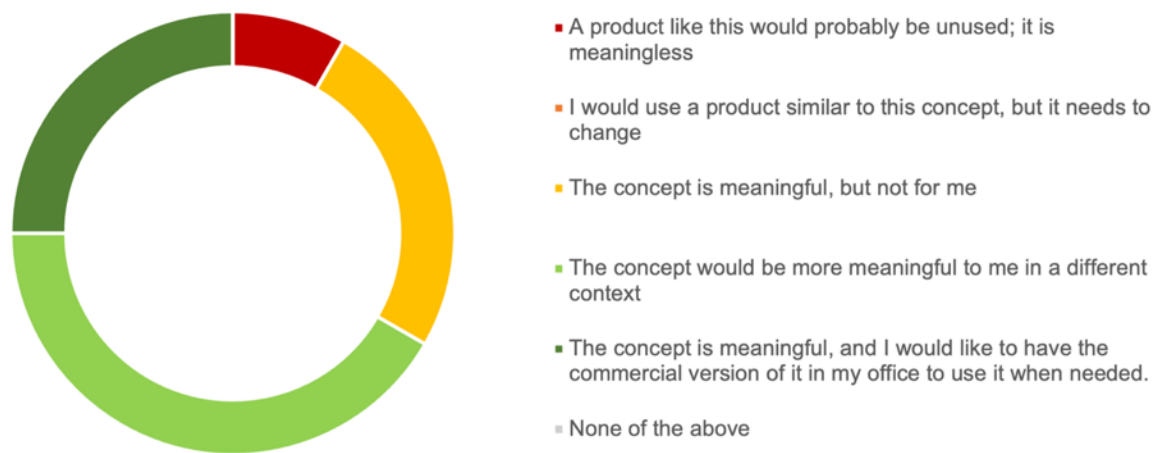


Figure 35. Responses from the users in the real estate company when asked what about the option that best represents their opinion of the second prototype.

Another important learning outcome concerns the differences between the office contexts where the prototypes were tested and their direct relation to the insights gained with research question 1. The users from the IT office regularly spend consecutive hours at their desks working on individual tasks that often required higher levels of concentration. Their office was characterised by an open-plan space with zones for assigned workstations, shared workstations, and workstations rented to externals. The users from the real-estate office, on the other hand, often worked at different locations and frequently interacted with colleagues and externals. Their office also had open-plan spaces, but it had more back-up spaces for different activities including a quiet room, all the workstations were shared and the zones were intended for different levels of interaction. These differences help explaining why the users from the IT office had an overall better experience and why they found value in the possibility to withdraw for a few hours when needed to work shielded from (visual) distractions or handle confidential information on their screens.

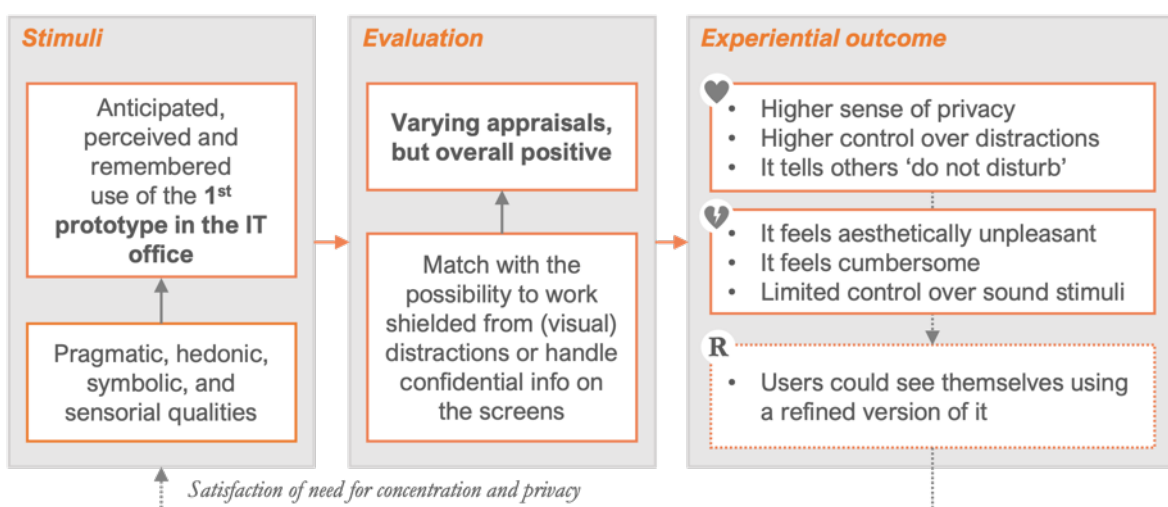


Figure 36. Illustrative example of the results in the IT office

The users in the real-estate office often indicated that the prototyped concept made less sense to them because of their highly interactive and mobile work routines and the possibility to withdraw to a quiet room. It was a tougher scenario for the furniture concept, although the second prototype was overall rated as meaningful, especially for those users working in open-plan spaces with fewer or no quiet spots, or in other contexts with high levels of environmental stimuli where some shielding may be desired, for example at an airport.

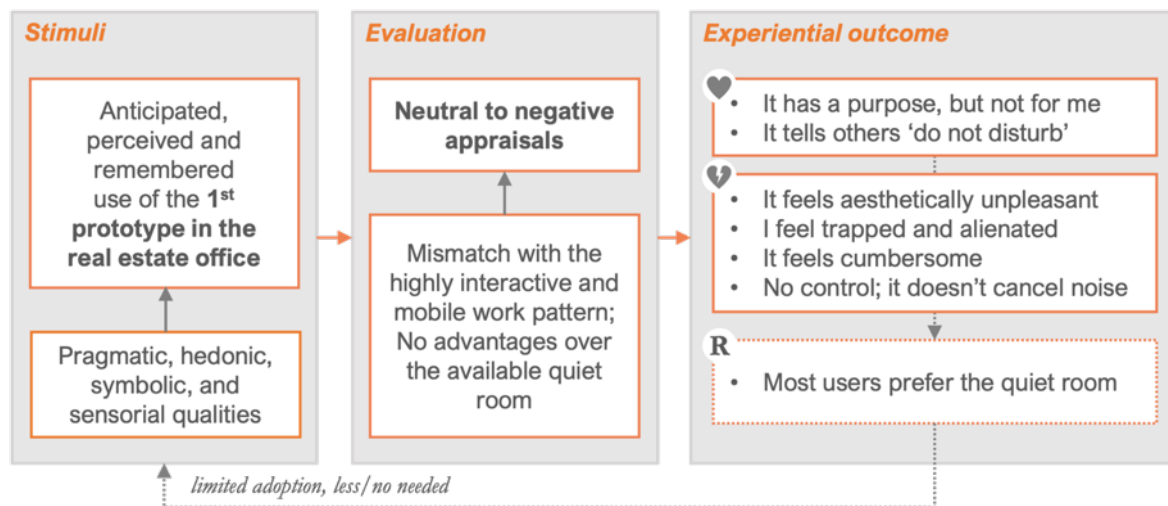


Figure 37. Illustrative example of the results in the real estate office

Altogether, the results evidence that the furniture concept tested should not be seen as (and it was not intended as) a universal solution but as one more means to improve user experiences with flexible offices for concrete user profiles, needs, and preferences. In that context, what would a third prototype look like?

The purpose was never to compete with noise-cancelling devices or fully secluded booths, but to explore a different approach to shielding users from stimuli. The experience of control over sound stimuli was rather mild, but control over visual distractions, privacy, or tasks was better. The second prototype improved other aspects of the experience beyond the acoustic properties and was appraised as meaningful even by users who were not necessarily in the need of it. Therefore, a third iteration should consider two possible routes:

- (i) Take advantage of the results achieved to focus solely on the aspects of the experience of control that were positive (e.g., control over visual stimuli/ exposure). This would make possible, for example, the removal of acoustic materials to achieve a lighter, more compact, and simpler design that still provides the preconditions for a positive experience.
- (ii) Rethink the strategy and explore a different type of solution.

In any case, and rescuing the answers to the previous research questions, designing flexible offices requires dealing with both specific details and systemic issues. The

two possible routes for a third prototype bring the attention to the specifics, so further testing in more offices should allow for a better understanding of its potential impact in different office ‘systems’ with different user profiles.

Overview of learnings from knowledge utilisation

Designing for positive user experiences with flexible offices entails great complexity. The collaboration between different stakeholders and with users seems fundamental to navigating such complexity and exploring design opportunities.

Designing for experiences requires focusing on the qualities of the experience rather than the qualities of a particular solution. This can help to expand the explorative design process, but it also involves making important decisions from the beginning of the process that can result in very different end solutions.

For the testing of a conceptual solution, it is important to match the prototype representation, its fidelity, and testing conditions with the feedback aimed; in this case, high-fidelity prototypes were tested in real office contexts to create the impression of a finished product and collect realistic feedback. This has relevant implications not only in terms of the extra resources necessary for every new prototype but also on the availability of users and places for the tests, even more so in a pandemic context.

Confronting users’ expectations, perceptions during use, and memories of use of a research prototype in their office context was fundamental to evidence that experiences are not designed, but their preconditions are. Then, testing the extent to which such preconditions enable the intended user experience in different contexts is an iterative process that may lead to new discoveries. Mapping these differences and discoveries on a system level is crucial to understanding how and if the intended experience takes place.

The necessity to handle complexity on the specifics as well as on a systemic level underlines the relevance of holistic research angles to user experiences such as UX. As highlighted in the introduction to Chapter 2, design education has evolved towards embracing a system’s perspective. This means that designing for highly complex systems is not only possible but becoming inherent to the design discipline.



5. SEEX model

This chapter elaborates on the theoretical development resulting from the UX frame of reference adopted and how user experiences were observed to take place in the different research activities. A joint interpretation of these is presented in the following lines that lead to a tentative model for understanding and studying UX with offices.

According to the UX frame of reference, user experiences are subjective and must be understood in relation to the user(s) who use a system in a context. Experiential outcomes are elicited by stimuli that are appraised by the users as significant for their own well-being. Users constantly appraise the situations in which they are involved, and their references for the appraisals are their own concerns, abilities, knowledge, and expectations. This process has been described in Chapter 2 as a cyclical three-phase model, in other words stimuli, evaluation, and experiential outcome (Figure 6), meaning that user responses to appraised stimuli and/or changes in the stimuli would trigger a new experiential cycle. This simplified overview of how user experiences take place has enabled me to study experiences with flexible offices based on a structured approach.

The various research activities conducted during my doctoral studies allowed me to gain a richer understanding of the process and the components of the experience. Correspondingly, the model for the study of UX with offices introduced in Chapter 2 is here developed further and named according to the three phases as the SEEX model.

Starting with the phase of stimuli (Figure 38), users can get involved in events of using a system either because they actively engage in the interaction with a motive, that is to say an internal drive, or because they encounter or are confronted by a system, in other words an external drive, for example moving to a private room for a call vs. having to cope with a malfunctioning climate system. Then, the event

of using the system is mediated by the system design qualities. However, study III showed that the anticipated experience of the prototype was influenced by the representation chosen for the test (pictures), as this determined users' interpretations. In fact, one could say that the physical prototypes themselves were representations of a product too. Hence, the stimuli phase in the model must acknowledge that the anticipated, perceived, and remembered events of use of a system are not only mediated by the design qualities of the system, but by the qualities of system representations too.

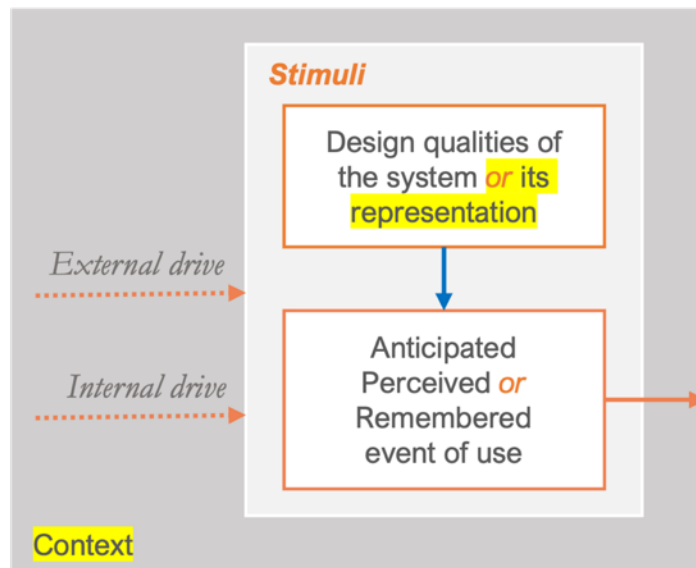


Figure 38. The updated phase of stimuli in the experiential cycle; changes with respect to the model in Chapter 2 are highlighted in yellow

Studies Ia, Ib, II and III emphasise the role of the context in establishing the conditions in which users will experience a system, for example the influence of social codes of conduct in the use of shared spaces. More importantly, the context not only determines the conditions in which stimuli are perceived, but also the conditions in which they are evaluated and responded to. For example, the same office chair could be appraised as uncomfortable in a context in which it is used and manipulated collectively (i.e., it needs readjusting every time before use), or as comfortable when the chair is in an assigned workstation and the user only needs to adjust it once. In addition, user responses to such appraisals may differ, for example, by taking a favourite chair to different workstations or leaving a note on the chair asking colleagues not to change the adjustments.

Therefore, appraisals and responses also change between the more public-collective or private-individual contexts, and not only according to the perceived stimuli. In this sense, the context remains as a background layer of complexity to the whole experience while it takes place, and it is represented differently in the SEEX model compared to Chapter 2.

Regarding the phase of evaluation (Figure 39), appraisal theories suggest that there are conscious and automated subconscious processes constantly appraising the surrounding stimuli (Lazarus and Smith, 1988). This is supported by the Activity Theory angle adopted for the analysis of study Ia (publication B), which also emphasises how so-called breakdowns can bring subconscious processes to the forefront of a user's attention, for example when an artefact does not work as expected. Similarly, there are conscious processes that over time are internalised and managed on subconscious levels, for example connecting a computer to a docking station. In this constant processing, any stimuli appraised as non-significant for the user's well-being will not elicit experiential outcomes (Lazarus *et al.*, 2001, pp.42-45).

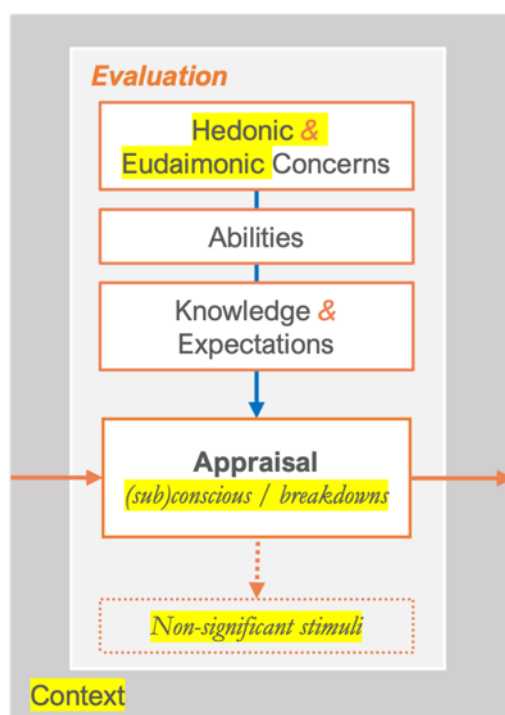


Figure 39. The updated phase of evaluation in the experiential cycle; changes with respect to the model in Chapter 2 are highlighted in yellow

As explained in Chapter 2, appraisal processes are mediated by the user's concerns, in other words needs, preferences, values, motives (Frijda *et al.*, 1986), their ability to process or act upon the stimuli, and knowledge and expectations when the stimuli are new to the user (Desmet, 2002). In this regard, users' concerns are further explained by theories of well-being in positive psychology adopted in the analysis of study Ia (appended publication A). These theories illustrate that there are hedonic (affects & satisfaction) and eudaimonic (personal evaluation, social relations, autonomy, environmental mastery, purpose & personal growth) concerns determining how users perceive situations. One implication of this is that appraisal processes may be influenced by users' orientation towards pleasure

or meaning in life, for example, the extent to which sumptuous or lean office aesthetics are experienced as relevant and positive.

Regarding the phase of experiential outcome (Figure 40), the users participating in the studies referred to experiences of different valence (i.e., positive-negative) and intensity (i.e., how positive or negative, or how severe the consequences were). Also, these experiences were ‘of’, ‘with’, or ‘through’ a system, depending on the roles of the system and themselves in the experience. For example, the experience ‘of’ an attractive office space, where the user is mostly a passive subject immersed in a situation and there is limited interaction; the experience ‘with’ a coffee machine where direct and deliberate interaction is necessary to obtain a freshly brewed coffee; and the experience ‘through’ a screen during a teleconference, where the screen itself acts as a vehicle of the experience that practically disappears from the user’s consciousness.

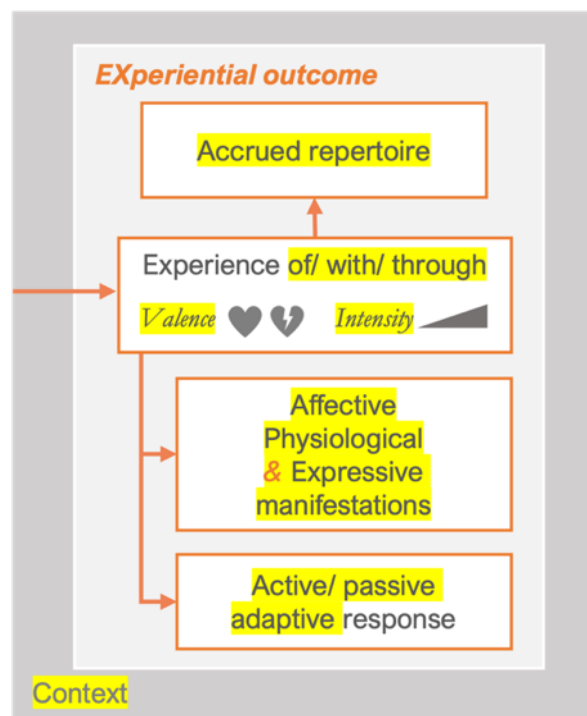


Figure 40. The updated phase of experiential outcome in the experiential cycle; changes with respect to the model in Chapter 2 are highlighted in yellow

Appraisal theories suggest that experiential outcomes elicited by an event of significance have an adaptive value in coping with such event, and that affective reactions comprise other changes on the physiological, expressive, or behavioural levels (Roseman and Smith, 2001, pp.8-9). For example, “the protest and attack behaviour that is characteristic of anger seems an appropriate response to physical or psychological harm inflicted by another person (insofar as it can alter the harm-doer’s behaviour or deter its recurrence)”. In this sense, the experiences of/ with/ through are considered in this model to relate to affective, physiological, and expressive manifestations, as well

as behavioural responses. Further, users' agency in changing the course of an experience is acknowledged in the model by distinguishing between adaptive responses of passive and active nature, for example coping with distractions by trying to ignore stimuli vs. moving to a quiet room.

Lazarus *et al.* (2001, pp.44-45) remark that individual responses are intimately related to their adaptive repertoire in the face of events. This implies that two individuals can experience a given stimulus differently, leading to diverse reactions, responses, and/or learnings. Accordingly, every experience is here considered to contribute to expanding or validating the users' repertoire to appraise and respond to stimuli.

In design terms, the user-system interaction has an impact on the user, not only due to the experience evoked but also on the user's knowledge, attitude and behaviours (Fokkinga *et al.*, 2020). For example, a user may struggle with a new printer at the office whose settings differ from the one used before but, with every use, the user progressively familiarises with the settings and even discover new functions that change the long-term experience with the printer. Such learning will feedback the mediating concerns, abilities, knowledge, and expectations in the evaluation phase for upcoming experiences with the same or other printers. This also explains why novel experiences are no longer experienced as novel after the first time.

This model is not only contributing to understand and study UX with offices, but to understand and map how UX takes place. Therefore, it represents a theoretical development that would also be applicable to other research contexts. The complete SEEX model is displayed in Figure 41.

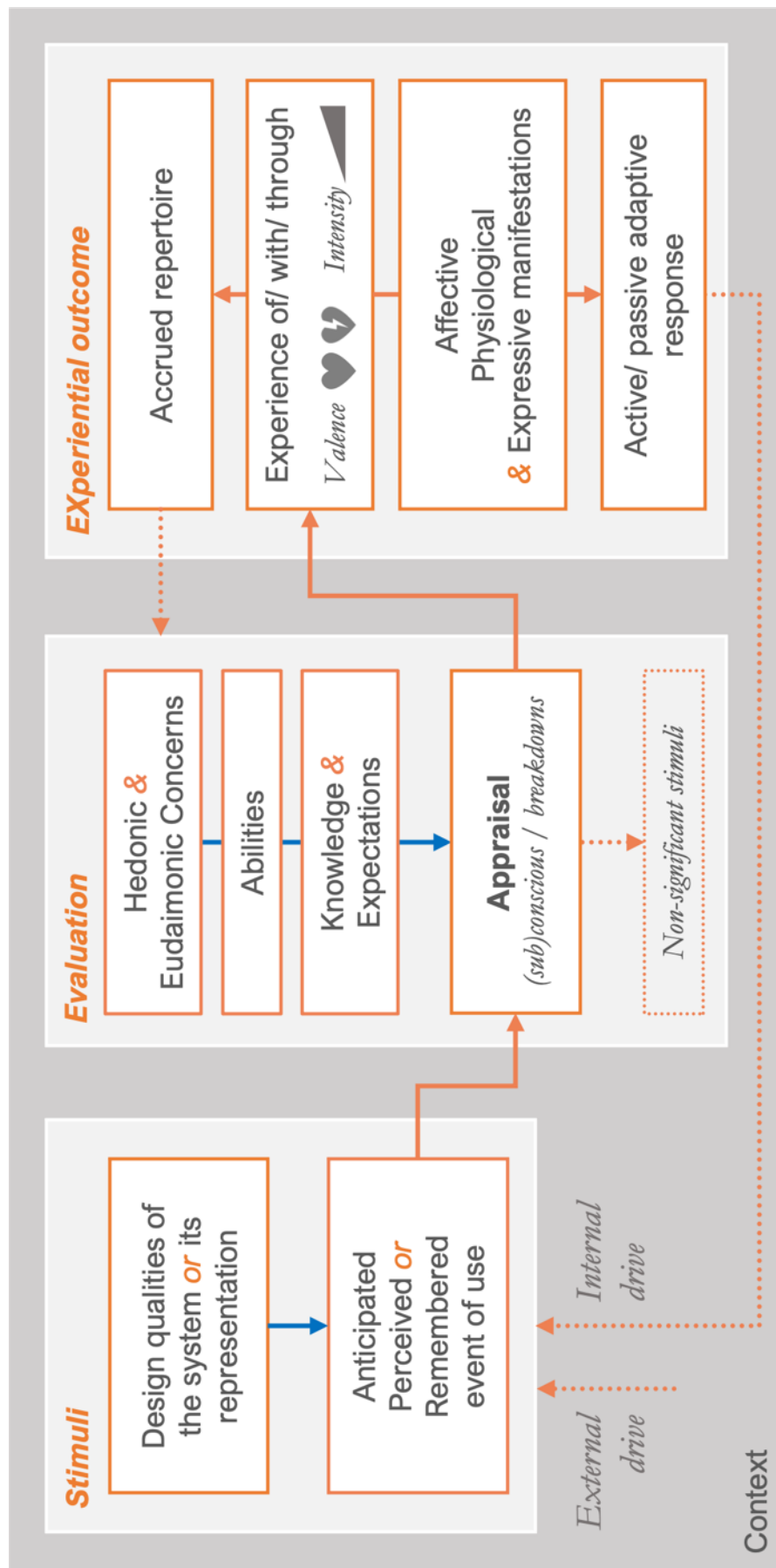


Figure 41. SEEX model for understanding and studying UX

6. Discussion

This chapter elaborates on (i) the discussion of findings in relation to previous literature, (ii) reflections on the research approach and methodological aspects of the thesis, and (iii) reflections on the UX perspective and the proposed SEEX model.

6.1. About the research findings

Users' personal control

The user experience of control relates to several of the design qualities highlighted in research question 1 (Chapter 4), it was one of the main experiential outcomes from which design implications were drawn (research question 2), and it was also the central theme in the exploration of design opportunities (research question 3). As defined in the appended publication A, the experience of control refers to users' sense of competence and ability to manage and adapt the office environment, take advantage of what it offers, and fulfil personal needs and values. In this sense, the experience of control has been central in all the studies, as well as in the design and tests of the research prototypes. For example, the visual and physical openness of rooms and zones enabled users to have greater visual control of their surroundings. On the other hand, the same design quality negatively influenced their experience of control over visual and auditory distractions and privacy. Studies of the effects of open-plan offices on users have reported similar experiential outcomes in relation to the open spaces (Göçer *et al.*, 2019; Kim and de Dear, 2013). According to Bodin Danielsson *et al.* (2014), personal control is strongly related to office employees' environmental satisfaction, as well as to the perception of privacy (Weber *et al.*, 2021) and distractions (Lee and Brand, 2010). Further, the provision of personal control in open-plan work environments is an important means of alleviating the adverse perceptions (Gou *et al.*, 2018). Whether

such control is provided by adding partitions to the layout or other design interventions must be decided according to the particularities of each case.

Another example relating to the user's personal control was the case of the automated climate systems, the blinds, and the lighting. In the case of the climate system and the blinds, the possibility of exerting control was non-existent. Related to this, Azizi *et al.* (2015) refer to three coping mechanisms as the users' responses to discomfort at the office: (i) technological or environmental adjustment (e.g., turning on fans or heaters), (ii) personal adjustment (e.g., adjusting activity, adjusting posture), or (iii) psychological adjustment (e.g., just put up with it, or try to ignore the problem). Hence, the coping mechanisms that the users experiencing visual or thermal discomfort had, were fundamentally limited to personal and psychological adjustment. Karjalainen (2009) states that users are more tolerant to comfort conditions if they have control over their own thermal environment, and may find exactly the same temperature variation acceptable or unacceptable, depending on whether it is chosen or imposed. Bordass *et al.* (2001) also mention a "forgiveness factor" of users who have control over their environment. In the case of lighting, the issue was that control was shared; the switches and sensors operated the lights for entire rooms or zones, leaving a limited margin of control over individual lighting preferences. The challenges for personal control in relation to shared lighting systems have been reported in previous studies (e.g., Lashina *et al.*, 2019), that also introduce the concept of consensus control to refer to personal control applied in shared office contexts (Chraibi *et al.*, 2016). Independently from individual or collective strategies of control, the key point here is that there are mechanisms for control as an alternative to lacking control that should be considered in office planning, development, and operation.

Related to the shared quality of artefacts were the difficulties experienced by the users in study II to adjust the different office chairs. In this case, the lack of control was not caused by an absence of adjustment options, but rather by the numerous and different mechanisms to be operated. According to Skinner (1996), the experience of control refers to a person's feelings derived from an interaction with the environment while attempting to achieve a desired outcome or prevent an undesired one. Further, "*experiences of control are products of external conditions (e.g., the degree of contingency between actions and outcomes), subjective interpretations (e.g., whether a success is believed to indicate ability or luck), and individual actions*" (ibid). Artefacts in flexible offices such as office chairs are expected to support individual and collective use (even more so when the workstations are shared). However, users' actions (i.e., adjusting chairs) were not always resulting in the desired outcome (i.e., comfort). Hence, the findings suggest these artefacts are still designed in the same way they were designed for the requirements of traditional offices, where the users rarely change adjustments once they find a comfortable ergonomic posture

(sometimes with the help of an ergonomist). This is a usability issue to be resolved by designing artefacts for sharing in multi-user environments.

During the studies, observations were conducted in parallel with other methods for data collection that served to verify the occupancy of the different spaces, among other things. This made it possible, for example, to find out that users' perception of occupancy of some back-up spaces such as teleconferencing rooms or quiet rooms was higher than the actual occupancy. The impossibility to see the status of all rooms in real-time could explain this perception. Such a situation is coherent with the notions of available and perceived control and reveals a design opportunity. According to Paciuk (1989) personal control over the office environment refers to three different aspects: (i) available control, i.e., the access and type of control made available by the environment (thermostats, operable windows, etc.), (ii) exercised control, i.e., the frequency in which user try to regain control by intervening the environment, and (iii) perceived control, i.e., level of influence of occupants on the building, dependent on the availability of building controls (available control) and on the use of those controls (exercised control). In relation to this distinction, Boerstra *et al.* (2013) barely found any significant correlation between available control and perceived control, but multiple significant correlations were found between perceived control and how occupants experienced the buildings. This indicates that actual control over the immediate environment may be less relevant for the user experience with the office environment, as long as the perception of control is positive.

In the collaborative DfUX project, personal control was approached from design research and practice perspectives to explore design opportunities that enable positive experiences of control over sound stimuli in flexible offices. The project's subject is relevant not only because of my findings or the interests of a leading furniture manufacturer. Both personal control (Skinner, 1996) and sound stimuli (Oseland and Hodsman, 2018) are topics that have been investigated for decades and, considering the extensive literature available, have attracted considerable interest in the study of offices. The appended publications A and C highlight the fundamental role of personal control over the environment for office users' well-being, in line with the findings from much earlier publications (Croome, 1999; Ulrich, 1991). Regarding sound stimuli, it is regarded as one of the most important issues influencing users' satisfaction with offices of all types (Appel-Meulenbroek *et al.*, 2020; Haapakangas *et al.*, 2017; Kim and de Dear, 2013). In the particular context of flexible offices, Babapour *et al.* (2020) indicate that exposure to stimuli and acoustics is one of the main factors underlying users' preferences and non-preferences for the different spaces. According to Skinner (1996) "*practitioners who attempt to optimize functioning may wish to begin with an analysis of the individual's experiences of control*". Consequently, any changes in objective or subjective control conditions,

or in other antecedent conditions that may alter control, should be analysed with respect to their likely effects on the users' experiences in the intervention context. Furthermore, office experiences are dynamic and evolve over time, so it may be useful to monitor the users' experiences of control as indicators of their adaptive processes to flexible offices.

From a design perspective, all these issues of control represent clear opportunities for intervention that are already being explored by other authors (Brager *et al.*, 2015; Dikel *et al.*, 2014; Kim *et al.*, 2018; de Korte *et al.*, 2015; Shahzad *et al.*, 2017). However, the latter authors and reviews on personal environment control systems (e.g., Godithi *et al.*, 2019) focus mostly on either thermal comfort or visual comfort. This indicates that there is a wide margin of potential to continue exploring new interventions.

In general, literature suggests that higher levels of perceived control over the office environment are supported by greater adaptive opportunities (e.g., Karjalainen, 2009) or ergonomic training (Babapour, 2019; Robertson *et al.*, 2009). There are also indirect strategies to enhance this control, or at least users' tolerance to situations where control is limited. For example, Knight and Haslam (2010) report on the positive impact observed when users can give their input to the design of their offices. To Rolfö (2018), user involvement was central in the success of relocation to a flexible office; users had a sense of ownership over the workspace, felt proud of their contribution, and reported higher levels of satisfaction overall. In a sense, it is like the 'IKEA effect' reported in Norton *et al.* (2012), where self-made artefacts have an increased valuation to their makers. Therefore, the experience of control is fundamental for positive experiences with flexible offices, there are different strategies to enable control, and these entail users exerting control rather than accepting that there is no control (i.e., control mechanism of psychological adjustment).

Experiences shaped by the shared quality of artefacts and spaces

The shared quality of artefacts and spaces in flexible offices is probably the most fundamental difference between flexible offices and other office types, and it also played a central role in the findings of this thesis. This design quality influenced how other qualities were perceived (research question 1) and had ramified design implications for the experiential outcomes referred in the answers to research question 2. It also influenced implicitly the exploration of design opportunities (research question 3), as the research prototypes were designed for a sharing scenario.

In studies Ia, Ib, and II, the users relocated from office rooms that were usually individual or shared with one more person, to office rooms shared by up to eight

users and open spaces shared by 12 or more users. These open and shared spaces enabled new opportunities to interact and more frequent encounters. The organisations hoped that this change would increase collaboration, but the users mostly experienced an increase in informal communication. In this regard, literature on open offices shows varying results; while some studies found that communication increased in spaces shared with more colleagues (e.g., de Been *et al.*, 2015; Engelen *et al.*, 2019), others found that face-to-face interaction decreased in favour of electronic interaction (Bernstein and Turban, 2018), or that the perception of communication worsened over time (Haapakangas *et al.*, 2019). Gerdenitsch *et al.* (2018) indicate that the interaction across teams increased right after the implementation of a flexible office design and stabilised in the longer term. The users in studies Ia and Ib highlighted that in their case the (lack of) collaboration was mainly due to their unrelated work topics and activity patterns. Therefore, open spaces alone are not enough to increase collaboration and can even be counterproductive if implemented with shallow criteria.

Sharing spaces also entailed limitations in the opportunities to customise workplaces. Overall, the organisations of the studied offices asked users to refrain from personalising office spaces, regardless of the existence or not of clean-desk policies (such as in those flexible offices with assigned workstations). Still, the extent to which such a limitation was positively or negatively experienced was rather dependent on the individual. Previous literature also identifies varying effects. For example, in Babapour and Rolfö (2018) there were instances of users who associated this with ‘nicer and cleaner’ spaces, while in Elsbach (2003) it was perceived as an identity threat. While clean-desk policies seem unavoidable to be able to share workstations, new design opportunities for positive experiences of individual and group identities in flexible offices still wait to be explored. In this regard, the thesis provides a reference for conducting such exploration.

When it comes to the sharing of artefacts such as desks, feelings of inefficiency, uncertainty and even stress were recurrent as experiential outcomes in study II. The feelings of inefficiency related to the need to search for and set up workstations every day, while the uncertainty and stress often related to not knowing if a preferred workstation would be available. In this regard, users often coped by choosing the same workstations for complete days and on consecutive days. Compliance with desk sharing and related coping behaviours has been addressed in previous studies with diverse results, although the users tend more often not to switch workstations (cf. switching patterns in Cobaleda-Cordero and Babapour, 2017). Moreover, previous studies have recurrently identified territorial behaviours in flexible offices, for example de Been *et al.* (2015) report that in 11 out of 20 case studies there were shared workstations claimed by the users. Brunia *et al.* (2016) note that the claiming behaviours of users to cope with the lack of

vacant workplaces reduced even more the availability of certain types of workstations. In the latter case, the ratio of users per workstation seemed determinant, but there are additional reasons explaining why users tend to occupy the same desks over time, for example to stay in close proximity to colleagues, or personal preferences.

In the case of users with higher internal and external mobility (i.e., working more often in different locations and interacting with different colleagues or externals), the findings indicate that they have more positive experiences with shared desks. They do not experience the same drawbacks, or at least not on a daily basis. The latter is aligned with previous studies in which users with more mobile and heterogeneous work patterns were more positive towards sharing workstations (e.g., Hoendervanger *et al.*, 2016; 2018). However, territorial behaviours with regard to shared workstations by users with lower mobility can cause mobile workers to have a poorer experience with flexible offices (Hirst, 2011). This suggests that users working most days at the office, with low mobility and homogenous work patterns, may feel and do better at work with an assigned workstation or at least with arrangements that guarantee an available workstation in a shared zone.

Understandably, in the flexible offices with assigned desks, such as the one in studies Ia and Ib, the users' experiences differed notably and they often pointed to their own workstations as their favourite place in the office. Having assigned desks in a flexible office has relevant experiential implications. For example, users will not need to set up their workstations before use, or deal with chairs whose adjusting mechanisms were not designed for shared use. On the other hand, assigned workstations enable users to replicate the habits of traditional offices where most tasks are conducted at the same workstation. In studies Ia and Ib, the users found it more convenient to stay at their own desks and deal with occasional distractions than to use back-up spaces. This helps explain, for example, the remarkably low occupancy of quiet rooms described in the appended publication B. Earlier research on the factors determining the success of relocation to flexible offices points here to two aspects as crucial: (i) functioning and desirable spaces, and (ii) sufficient collective artefacts that are easy to use and share among users (Babapour, 2019). The complex, contextual, and ramified implications of shared artefacts in flexible offices emphasise the pertinence of assessing the need for shared or assigned desks from a user perspective. Nonetheless, research on the experiences with shared artefacts remains limited (Colin and Brangier, 2020).

Co-experiences and socially constructed experiences

Co-experiences and socially constructed experiences relate to a notable extent to the above-highlighted shared quality, and have analogue implications for the three

research questions of this thesis. Sharing spaces with others entailed the need of following certain rules, to cope with the lack of rules or with the lack of compliance to rules. The lack of rules or lack of compliance were recurrent in the offices studied, for example in study II users reported repeated misuse of zones. This resonates with what Forlizzi and Battarbee (2004) called ‘co-experience’, as the user experiences in social contexts occurring with and being influenced by other users. Other authors investigating the adoption of collective rules and policies in flexible offices point to the ambiguity of rules as a cause not to follow them. For example, Babapour and Rolfö (2018) studied four flexible offices and found that *“a better compliance with rules occurred when (i) the employees were well-prepared and had a unified understanding regarding how and why to follow the rules, (ii) the rules were explicitly communicated and were regarded as easy to follow, and (iii) following the rules facilitated work and improved work conditions”*.

In the offices that I have studied, these collective experiences and rules were also affected by the openness of rooms and zones, as it made it easier for the background noise to spread around. Each of the rooms and zones seemed to adopt its own social codes of conduct in studies Ia and Ib due to the absence of rules; in study II, the organisation was explicit about the zoning, but certain zones and rooms were appropriated by groups who informally agreed on the uses of the space independently of the zoning. This was interpreted as misuse of zoning by others and generated the preconditions for suboptimal experiences of autonomy. According to Ryff and Keyes (1995) autonomy refers to the ability to think, judge, act, and behave according to personal standards resisting social pressures. In this regard, the users of flexible offices have the advantage of being able to choose different settings for different activities and preferences. However, in study II the differentiation of zones mainly relied on the proportion of soft-seating options vs. workstations with desks. The intended use of zones was only explicit in brochures with office maps. This contributes to explaining why rooms and zones were often used according to informal group rules and suggests the need for clearer design cues contributing to the differentiation of zones.

Users in studies Ia, Ib and II expressed their concerns or conflicts in relation to the ‘co-experience’ of spaces for concentration, for example concerns over disturbing colleagues in quiet zones that were ‘too quiet’, or conflicts when available workstations in small quiet rooms were not used if someone else was in the room. The latter also seems to relate to the dilemma between the preference for a quiet room and the need to handle phone calls somewhere else. Related to this, Hoendervanger *et al.* (2016) discuss that very heterogeneous work patterns result in multitasking and can be better supported with a single multifunctional workstation. The users who occupied the small quiet rooms also highlighted the possibility to multitask, which links back to familiar habits with their cell-offices

before relocation. This also helps with understanding why the second desk in the small quiet rooms was not used; the room would not be as convenient for multitasking with someone else sitting by the next desk.

These mismatches between users' motives and spaces also evidenced the discrepancies between the actual use of spaces and the use intended by the planners and decision-makers. In this sense, existing literature on office user studies emphasises the role of participative processes as central in the management of relocation processes and their impacts on users (Babapour, 2019, p.109; Hongisto *et al.*, 2016; Lahtinen *et al.*, 2015). Also relating to this, Broberg *et al.* (2011) elaborate on mediating artefacts, methods, discourses, and processes referred to as 'boundary objects' (abstract and concrete) for successful co-creative workplace design processes with the users of workplaces both in industrial and office settings. Accordingly, one can presume that the participation by users in office changes facilitates the acceptance of these changes over time, even if the acceptance does not necessarily imply satisfaction.

The flexible office arrangement and the spaces for breaks shared across units also influenced the user experience of community. In studies Ib and II this was underlined by some users as a cause for more social encounters on a global level, but a lower feeling of belonging to their units. Haapakangas *et al.* (2019) and Berthelsen *et al.* (2018) also identified a decrease in the sense of belonging after relocating to a flexible office, although in the first case it was related to difficulties in finding colleagues, and in the latter case it was related to fewer common coffee breaks leading to poorer cohesion. On the other hand, Robertson *et al.* (2008) indicate an increase in the sense of community on an organisational level. This suggests that flexible offices entail relevant changes in the user experience of community compared to traditional offices; a lower sense of belonging to the smaller groups and work units that require the attention of planners and decision-makers, and which may be replaced to different extents by a sense of belonging to the bigger group on an organisational level.

The users' co-experiences with the flexible offices were also influenced by contextual aspects with systemic implications. In study Ia, for example, the users said that their office pre-relocation was worse in almost every aspect, but sharing rooms with more colleagues resulted in divergent opinions about the new office. The premises were appraised as a notable upgrade, but the users were accustomed to individual rooms or rooms shared with one more colleague. The former office type was also a contextual factor identified in study II. Previous literature (e.g., van der Voordt, 2004) also mentions this aspect in the analysis of two cases of users relocating to flexible offices: those who relocated from cell offices reported a notable decrease in their perceived productivity due for example to the increased

exposure, while those who relocated from open-plan offices had the opposite perception due to the ability to move to quieter places. Therefore, providing additional back-up settings and opportunities to control/regulate exposure and interpersonal interactions seems relevant. In this sense, the prototyped furniture concept tested in study III conveyed a “do not disturb” message to the users in the surroundings that exemplifies how a single artefact can shape a systemic co-experience too.

Organisational and managerial aspects of the relocations to flexible offices were also important in shaping the collective experience with the office. For example, in studies Ia and Ib the users had high autonomy in choosing when and where to work and some users regularly chose to work remotely. This partly explained the overall low occupancy of the office rooms and the very low occupancy of quiet rooms. Moreover, the lower occupancy prevented downsides from becoming critical issues, as crowding is featured as an environmental stressor causing social withdrawal, anxiety, or tension (Bilotta and Evans, 2012), as well as poorer health (Herbig *et al.*, 2016). Therefore, complementing flexible office designs with flexible work policies seems a good strategy to enhance the user experience of autonomy and their ability to cope with stressors. However, granting users the autonomy to work when and where they choose requires a different approach to quantify the space that organisations must allocate to fit their processes (de Bruyne *et al.*, 2014).

Either it has a purpose, or it is not used

The back-up spaces in flexible offices offered users a wide range of options for activities such as breaks, meetings, phone calls, concentration and so on, as well as the opportunity to satisfy their preferences. However, there were instances in all the studies (therefore also concerning the three research questions) of artefacts and spaces that were/ would be underused:

- In studies Ia and Ib the occupancy of back-up spaces such as quiet rooms was low. The users had assigned workstations that together with the meeting rooms covered most of their needs, so they preferred to stay at their desks and deal with occasional distractions.
- In study II there were artefacts and spaces such as the soft seating areas, phone booths and pay-per-use meeting rooms that were barely used. The users appraised these as limited in functionality or comfort, or less convenient than other settings for their activities.
- In study III, the furniture concept was appraised as meaningful, but the extent to which users said that they would use it varied notably between the two offices due to fundamental differences in activity profiles and routines,

that is to say, frequent individual and desk-bound work in the IT office vs. highly interactive and mobile work in the real estate office.

These findings are compatible with earlier studies which indicate that users' use of different workstations did not necessarily relate to their activities, but rather to personal preferences for certain places, staying in proximity to team colleagues, or the feeling of wasting time when switching workplace settings (Babapour *et al.*, 2020; Hirst, 2011; Hoendervanger *et al.*, 2016; Qu *et al.*, 2010). Furthermore, the differences in activity profiles have also been identified in Hoendervanger *et al.* (2021) as a key factor explaining the users' perceived fit in the use of different work settings for their work activities. Therefore, gaining a rich understanding of users' routines, preferences and motives can anticipate relevant information on the back-up spaces that may (not) be needed. This allows for more effective and efficient office planning and incremental improvements, as the underused artefacts and spaces represent a significant expense for the organisations. In line with this argumentation, Bruyne and Beijer (2015) propose the PACT model to calculate the mix of spaces needed in flexible offices, although their model mostly focuses on users' activities and work patterns. More cost-effective utilisation of resources requires office artefacts and spaces to be desirable and purposeful for users (Babapour *et al.*, 2020). Still, what is desirable and purposeful varies between cases as the user tests with the prototypes also show. The furniture concept prototyped represents one more option for flexible office environments that satisfies the specific needs of a group of users (not all).

The user experience angle adopted in this thesis for the exploration of design opportunities addressed this issue closely and may inspire alternative approaches for the planning and operation of offices. After all, the users base their 'use' decisions on their own concerns, abilities, knowledge, and expectations, which determine whether the office spaces and artefacts are appraised as beneficial, irrelevant, or harmful. Instead of assuming that users will embrace new routines and habits due to new office preconditions, these preconditions must be meaningfully adapted to the users.

6.2. About the UX research frame and the SEEX model

UX: a multidisciplinary research angle

This thesis is anchored in a user-centred design tradition and adopts UX as a frame of reference. UX is a research field in accelerated expansion. The research profiling study by Roto *et al.* (2021) reveals that 80% of the user experience publications have appeared during the 2010s, almost 50% have been published between 2014 and 2018, of which the last two years count for more than 23% of such publications. Today UX is an extraordinarily rich field for design research due to its engagement with multiple disciplines since its early days (see the introductory

section of Chapter 2). It is no secret that some of the most cited authors in the UX field were not designers when they defined their views on what user experience is or how to design for it. For example, Norman has a background in electrical engineering and psychology; Hassenzahl has training also in psychology; Roto comes from the field of computer science; Jordan studied mechanical engineering, ergonomics, and psychology. Others such as Desmet did a masters and PhD in the design engineering field. Thus, the following excerpt from Cross (2007b) seems highly pertinent: *“Many researchers in the design world have been realising that design practice does indeed have its own strong and appropriate intellectual culture, and that we must avoid swamping our design research with different cultures imported from either the sciences or the arts. This does not mean that we completely ignore these other cultures. On the contrary, they have much stronger histories of enquiry, scholarship and research than we have in design. We need to draw upon those histories and traditions where appropriate, while building our own intellectual culture, acceptable and defensible in the world on its own terms”*.

The design discipline is relatively young, but its evolution also shows that it is pragmatic by nature in its ‘designerly’ ways of studying the human factor in relation to technology and the world. UX design borrows and produces knowledge and practices that are, among other things, tools for action and problem-solving. This thesis, the SEEX model, and the publications appended to it have recurrently adapted references from the fields of positive psychology (Ryan and Deci, 2001) and cognitive emotion psychology (Roseman and Smith, 2001; Smith and Lazarus, 1990) to design research purposes. The main reason for this choice is that these fields of psychology focus on the aspects that support human well-being, rather than the aspects causing ‘ill-being’. So, it is about experiences that enable humans to thrive, and I as a design engineer and user researcher have the responsibility to contribute to a positive impact on society. Furthermore, Desmet’s (2002) comparison of the different traditions in the research of emotional experiences (evolutionary, bodily-feedback, and cognitive traditions in Desmet, 2002, pp.7-11) led me to read more in-depth about and finally choose Appraisal Theory as the cornerstone for my framework. According to Desmet (2002), the cognitive perspective (grounded in Appraisal Theory) on the elicitation of emotional experiences offers the best clarifications to how a product can elicit different affective experiences in different users (pp.10-11), and how different appraisal patterns lead to the same experiential outcome (pp.127-133).

Practical implications and considerations in the study of UX

As highlighted in the discussion of appended publication D and Chapters 2 and 5 of this thesis, the temporal dimension of UX plays a central role in the in-depth understanding of users and how they appraise the ‘systems’ in use.

In the office studies the focus has been on recalling users' memories, insights, and feelings about episodic and cumulative experiences of using office artefacts and spaces. Literature on what individuals may recall refers to the 'peak-end' effect (Cockburn *et al.*, 2015; Fredrickson and Kahneman, 1993) to explain that memories of past experiences tend to be biased by the most intense and the most recent episode of such experiences. For example, a negative experience with a workstation due to a usability issue with the adjustments may influence what the user remembers of an otherwise fully equipped and functional workstation. This implies that the user insights may be biased and refer to events that do not fully represent the actual experience with the workstations. In this sense, including the anticipated and momentary experiences in the office user studies, as done in study III, could retrieve relevant insights on (i) the users' experiential outcomes while using each of the artefacts and spaces, beyond their most vivid memories, (ii) how users interpret and expect the artefacts and spaces to be, and (iii) to what extent their expectations correspond to what they experience later on. For example, considering the temporality of user experience in study III enabled testing users' first impressions regarding their visceral and reflective reactions to the shape of the product, what functions to expect of it, and their predisposition to use it. Most importantly, collecting user insights on different temporal frames gave me a more precise understanding of what, when, and how in the experiential process needed to be revised to improve the overall experience with the concept.

However, the 'peak-end' cognitive bias also gives the opportunity to enhance suboptimal experiences with design interventions aimed at the 'peak' and the 'end' moments (cf. Caraban *et al.*, 2019; Kahneman *et al.*, 1993). Therefore, the thesis findings are considered representative of relevant and real office experiences. More so, these findings give facility managers, designers, architects, and other stakeholders involved in office planning, development, and operation a base of knowledge that can be utilised for design interventions beyond the one reported in research question 3 about the experience of control.

The user's appraisal has been portrayed in this thesis as the basis of the experiential process in determining whether perceived stimuli are beneficial, harmful, or not significant for the users' well-being (Desmet and Hekkert, 2002; Scherer, 2005; Smith and Lazarus, 1990). When the stimuli are appraised as not significant, they do not elicit a response (Lazarus *et al.*, 2001, pp.42-45), and may remain unnoticed by users. However, there may be significant stimuli whose processing is internalised by the users due for example to habits or practice. These may also remain unnoticed and make it difficult to know if users omit issues in the studies because these are irrelevant or because they do not realise they are internalised. Methods to elicit tacit knowledge are fundamental in this regard (Visser *et al.*, 2005). Coherently with this, I assume that the experiential outcomes identified in

the different studies are those of higher significance for the users' well-being. Whether other stimuli of lower significance omitted by the users participating in the studies can further elucidate the qualities of their experiences remains to be explored, although their capacity to elicit experiential outcomes should be limited.

There is also a general limitation of case study approaches (such as the one in this thesis) for the study of UX that relates to the lack of data on those users who decide not to participate. This represents a potential selection bias, even though the samples of my studies were representative of the different profiles/work units, and I collected a mix of positive and negative appraisals of the flexible office. Consequently, I must assume that the experiential outcomes identified in the studies are those of significance, and that those users who did not participate have either no/limited interest, no significant experiences to report, or experiences that fall within the spectrum of experiences identified among the participants.

User experiences are subjective and vary between users, but as indicated by Desmet (2002) patterns eliciting particular experiential outcomes emerge from the observations of many users. This *“can be used to facilitate the designers’ structured attempts to ‘design for experience,’ that is, attempts to deliberately influence the experiential impact of new designs”* (Desmet and Hekkert, 2007). Both appraisal patterns and the aggregated knowledge of suboptimal experiences can help to improve, at least, the situation of those who reported negative experiential outcomes with the flexible office studied and other similar cases.

The SEEX model

The frame of reference adopted in publication D and Chapter 2 is a combination and synthesis of existing UX frameworks. The representation shown at the end of Chapter 2 (Figure 6) provides a simplified overview of how user experiences take place. As acknowledged in Roto *et al.* (2021), the UX field is populated with plenty of frameworks and models that share some conceptual notions, but so far there is no unified view. In cases like this, the combination of models and theories has been utilised (e.g., Venkatesh *et al.*, 2003) to facilitate a structured and more efficient approach to research endeavours that other studies can later reproduce.

The SEEX model develops the UX model of Chapter 2 one step further. The different research activities conducted during my doctoral studies have made it possible for me to gain an even deeper understanding of how user experiences take place. Transferring and integrating this understanding into each of the components of the tentative SEEX model has been a natural step in my research process.

On a conceptual level, this model is not drastically new because the underlying constructs, theories, and models taken as a reference are well known in other UX

research domains. However, considering the recent compilation of workplace theories by Appel-Meulenbroek and Danivska (2021), it does propose a distinct angle to the study of offices. The SEEX model allows mapping the complex and multi-layered nature of user experiences around the process of appraisal and across the phases of stimuli, evaluation, and experiential outcome. Moreover, it contributes to the literature on office user studies with a well-founded frame to understand and structure the study of user experiences and the (re)design for experiences with offices. In this sense, it is not a model that only served the purpose of my thesis or my own learning, it also serves as a reference to continue acquiring knowledge about user experiences within and beyond the office context.

6.3. About the research work

I have used different strategies that are relevant for both the (mostly) qualitative and quantitative research conducted (Creswell, 2014, pp. 201-204; Miles *et al.*, 2014, pp. 310-315), to ensure the quality of my analysis, findings and conclusions regarding objectivity/external validity:

- The methods and procedures are described explicitly and in such detail that it allows an outsider to audit the research conducted.
- The researcher has been explicit and as self-aware as possible about personal and research assumptions, his role in the different stages of the thesis, and how these come into play in the research conducted.
- The congruency of findings is contrasted with previous evidence in the field of the studies.

reliability/dependability:

- The research questions and the way they relate to the research activities and theory have been unambiguously displayed.
- Joint analysis of the data collected was carried out between members of the research team/co-authors of the publications, and discussions were encouraged to further develop the analysis.
- The research included here has been discussed with fellow researchers and supervisors, presented at seminars and conferences, and peer-reviewed, giving the opportunity for thorough feedback and mitigating potential biases in the process.

internal validity/credibility:

- Context-rich and transparent descriptions of the research activities conducted were provided in all the publications, including the context of the studies, the participants, the methodology used, the data collection, and the analysis processes.

- Multiple complementary methods and data sources were combined to ensure the integration of different perspectives and to allow rigorous explanations of converging conclusions or their differences.
- Limitations, negative outcomes, and potential confounding variables such as the context have been identified, reported, and discussed in every study.
- Evidence from literature (both confirming and contradicting) has been actively reviewed and considered in the discussions of findings.

utilisation/application,

- Consent for data collection from the informants was obtained, the right to withdraw consent and participation was informed, and their anonymity was guaranteed in the communication of results.
- The findings are accessible, provide an intellectual basis, and also include ideas for readers to develop their own application in research and/or practice.
- The usable knowledge comprises insights with both practical and theoretical implications and suggestions, including a tentative model for the study of user experiences.

and transferability:

- Studies are limited to real office environments only, seeking to gain users' spontaneous and realistic feedback.
- Preliminary results were presented to the participants in the office studies to get their feedback and confirmation. The results from the collaborative project were also presented to the furniture manufacturer to obtain feedback and discuss the process and outcomes.
- The research approach is described in rich detail to make it comparable to and replicable in equivalent studies in the field.

The emphasis on qualitative data, the sample sizes, and the rich level of detail intended for the analyses limits the possibility to generalise the findings, which is not the intent of qualitative inquiry (Creswell, 2014, p.203). Establishing cause-effect relationships between design qualities and experiential outcomes in a general sense would require wider samples and greater emphasis on quantitative enquiries. In other words, the methodological approach would have served a different purpose from the beginning. Nevertheless, *“theory building from multiple cases typically yields more robust, generalizable, and testable theory than single-case research”* (Eisenhardt and Graebner, 2007), so the compilation of new and similar cases should enable a better comparison and further identification of trends, for example regarding experiences with shared artefacts and spaces. In this sense, it is likely that the

findings of the office studies in this thesis are also transferable to those offices with similar relocation preconditions and design characteristics.

Methodological considerations

Overall, the study of user experiences with office artefacts and spaces requires looking beyond the instrumental value of engineering or isolated aspects of the experience such as satisfaction rates or usability aspects. The latter is regarded as a ‘task-focused’ analytical approach widespread in the field of HCI that is reductionist in comparison with ‘experience-focused’ and more open-ended approaches able to capture the subjective nature of user experiences (Kaye, 2009, p.66-69). The book *Funology 2* (Blythe and Monk, 2018) gives further accounts of the necessary shift from instrumental to experiential approaches in the study of the interactions between humans and ‘things’.

For the office user studies conducted during the first stage of my research, different qualitative and quantitative methods such as interviews, observations, questionnaires, card sorting, UX curve mapping, and spatial walkthroughs were used. Mixed-method approaches allow researchers to obtain more complete and corroborated results, to compensate the weaknesses of a method with the strengths of other, and to explore information that is not accessible through a single approach alone (Creswell and Plano Clark, 2017, pp. 8-9). In this thesis, my overall approach leaned more towards the qualitative end, but mixing methods allowed me to acquire comprehensive knowledge about the interrelations between office design qualities and experiential outcomes, as well as how this related to office use.

In the collaborative project with the furniture manufacturer, the methods were mostly oriented towards exploration, creativity and decision-making. Methods such as photo elicitation, spatial walkthroughs, 635, SCAMPER, and experience sorting group were used, in addition to numerous discussions on custom-made charts, pictures, sketches, and a full-scale mock-up. This methodological toolbox and approach to idea generation and decision-making resonates with design thinking practices in the resolution of indeterminate, wicked problems (Buchanan, 2017; Cross, 2007b; Dorst, 2011). In this thesis, the exploration of design opportunities required defining a particular subject out of the problems and issues identified in the office user studies, and reliance on abductive reasoning or ‘qualified guesses’ that needed to be empirically tested (Laursen and Haase, 2019), for instance through user tests with the research prototypes.

Both printed and online surveys were utilised in the user tests before, during, and after the users used the furniture prototype in two offices, to monitor user experiences over time (cf. Roto *et al.*, 2011). This was followed by focus groups to

gain a wider understanding of the context of use, the peaks, ends, and overall experience, and the users' suggestions to improve such experiences with a succeeding prototype iteration. The succession of prototype iterations is inherent to Research through Design (RtD) approaches in the exploration of a research subject (Keyson and Bruns Alonso, 2009; Stappers and Giaccardi, 2017), and it further aligns the thesis with the paradigm of 'designerly thinking' (Cross, 2007b; Laursen and Haase, 2019). In particular, the explorative process followed together with the furniture manufacturer, and the focus on designing for a new experience of control over environmental stimuli matches the 'Innovation of Meaning' design thinking approach as defined by Dell'Era *et al.* (2020), that is, envisioning new strategic directions, a novel interpretation of how and why something is meaningful to users.

Triangulation of methods and data sources has been utilised throughout my doctoral studies as a strategy to manage "*the richness of the phenomenon and the extensiveness of the real-life context*", which requires coping with "*more variables of interest than data points*" (Yin, 2009,p.2). Further, this triangulation contributes to controlling both the participants' and the researcher's biases by enabling me to contrast and compare findings on, for example, the spread and recurrence of the issues identified in the studies. However, the triangulation of qualitative and quantitative methods has some implications in terms of (i) time: extensive data collections and analyses demand more time, and the analysis of qualitative data is particularly time-consuming; and (ii) expertise: wider research expertise is required to successfully utilise the diverse methods for data collection and to comprehensively cross-interpret data sources that may converge, diverge, contradict, or support each other.

Derived from the triangulation of methods is also the responsibility placed on the participating users, given that providing the researcher with the necessary data implies important amounts of time and trust. Case-specific circumstances, such as high workloads or fear of lacking secrecy, may negatively affect users' willingness and/or availability to participate. This may result in constraints for the studies that require me to work with what is feasible in each situation, also considering that convenience sampling may be the only option in some cases. In the studies included in this thesis, all the users from each office were invited to participate, and the representativity of the users participating in relation to the whole group was verified to limit the risks of sample bias.

In addition, the extremely limited access to users or offices for new studies over the last two years has been a severe burden to overcome. Substantial efforts were made with the planning and execution of research activities to palliate or prevent the health threats and restrictions derived from the pandemic situation. Both

before and during the pandemic, research activities have been planned and designed to match time and resources available, accessibility to users and locations, office characteristics, organisations' size, involvement of management, and sector of activity, among other aspects.

Bridging research and practice to explore design opportunities

Exploring design opportunities with the furniture manufacturer, an industrial partner expert in product design and development, has also enriched the research included in this thesis, as the workflows of science and engineering are not necessarily paired. Indeed, Drexler (2013) states that *“at the deepest, epistemic level, scientific inquiry and engineering design face opposite directions”* (see Figure 42) but that *“meshing design with inquiry can be as vital as hand-eye coordination. Engineering new instruments enables inquiry, while scientific inquiry can enable design”* (Chapter 8, p.4).

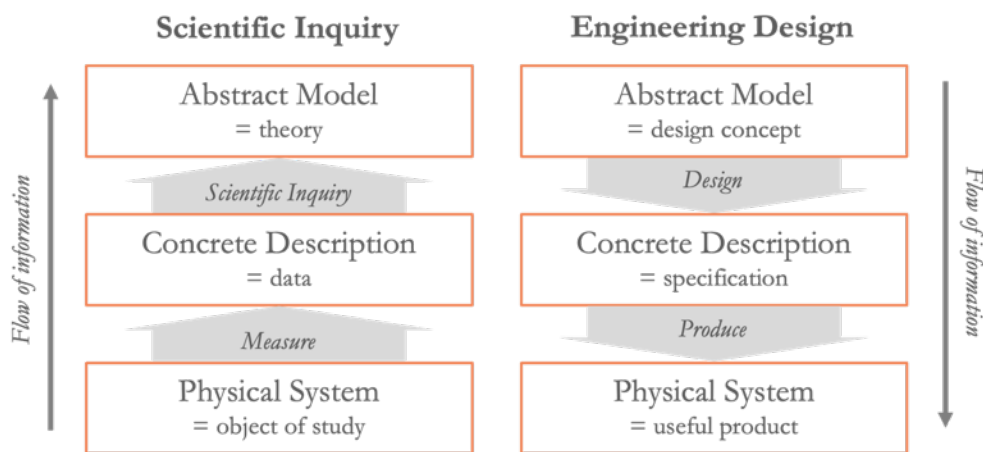


Figure 42. The antiparallel structures of scientific inquiry and engineering design in Drexler (2013)

This way, the collaboration with the furniture manufacturer closed a loop in which my research on a physical system (i.e., offices) contributed abstract knowledge that made it possible for practitioners to contribute to redesigning the physical system that I study.

My dual role as a facilitator first, and as a facilitator and active participant later in the process, aligns with the principles of Action Research and *“the active and deliberate self-involvement of the researcher in the context of his/her investigation”* (Mckay and Marshall, 2001). Action Research has been criticized due to the risk of bias and influence on the use of the information (Baskerville and Wood-Harper, 2016). To mitigate these risks, my role in the first three sessions with the furniture manufacturer focused on facilitating the exposure of common areas of interest for the exploration of design opportunities, and the screening of these by the company representatives. Thus, the decision power of the research process resided with the company representatives. Once the project goal was concretised with the experiential proposal in the third session, I started to participate in the decisions.

Transparent and detailed accounts of the collaborative process have been given in the appended publication E.

The collaborative design project and user tests conducted with the furniture prototypes in two offices were framed in a ‘Research through Design’ (RtD) process for the exploration of ‘design for UX’ opportunities. RtD processes are those *“in which design practice is brought to bear on situations chosen for their topical and theoretical potential, the resulting designs are seen as embodying designers’ judgments about valid ways to address the possibilities and problems implicit in such situations, and reflection on these results allow a range of topical, procedural, pragmatic and conceptual insights to be articulated”* (Gaver, 2012). Accordingly, the furniture concept prototyped was not intended to test the potential for a marketable product but rather to contribute further to research knowledge (Zimmerman and Forlizzi, 2008), even when both ends are not necessarily mutually exclusive. Therefore, the prototypes were research artefacts, mediation tools, to explore and experiment with the idea resulting from the collaborative project with the furniture manufacturer. The reason why such testing with users is highly significant is explained by Buchenau and Suri (2000): *“people’s experiences with products and systems are a complex integration of personal and circumstantial factors. People will have experiences with the things we design, whether we intend them or not, and in ways that we cannot hope entirely to predict”*.

Prototypes are commonly used to examine design problems and evaluate certain qualities of a conceptual solution according to a purpose, such as testing sensorial, ergonomics, or usability aspects (Houde and Hill, 1997, p.367). Accordingly, choosing the right resolution and fidelity were key design decisions that had to be taken for the first and second prototype iterations tested in study III.

Prototype-driven approaches are regarded by Elverum *et al.* (2016) as a strategy in Design Thinking that facilitates the development and transformation of novel ideas into tangible models that can be evaluated. Despite the different prototyping cultures between fields (cf. IT industry vs. automotive industry cultures in Schrage, 1996), innovative organisations utilise and iterate prototypes as a driver of the innovation process (Hughes and Cosier, 2001).

6.4. Remarks for future research and practice

The knowledge acquired in the earlier stages of my doctoral research indicates multiple areas in which the experiences of users with flexible offices could be improved (e.g., the experience of purpose, community, or autonomy). The collaborative DfUX project served to address the experience of control over the office environment, which is (just) one of these areas. Moreover, while exploring design opportunities with the furniture manufacturer, different suboptimal experiences of control were discussed beyond sound stimuli, for example suboptimal control over furniture adjustments, lighting, privacy, or visual

distractions (publication E). This means that there is a wide array of experiential domains that could be explored in research and practice based on the findings of this thesis alone. Moreover, the same RtD process can be replicated to explore all those experiential domains.

Collaborative/co-creative/co-designing processes have a valued and long tradition in the design discipline (Sanders and Stappers, 2008) and often focus on the interaction between specialist profiles (practitioner/researcher) and users (Conceição and Broberg, 2018; Eriksson *et al.*, 2015, 2020; Gomes de Lima *et al.*, 2021). In this thesis, the collaborative exploration of design opportunities for positive user experiences with flexible offices enabled a common space between design research and practice for discussion, design, discovery, and the exchange of know-how. Users were involved before and after this collaborative project, but not in the decision-making and the development.

This was a conscious choice and also an accepted practice in design thinking to address complex design problems and the redefinition of future scenarios (cf. see approach ‘innovation of meaning’ in Dell’Era *et al.*, 2020). Nevertheless, the users’ role in knowledge generation was crucial, and I can only encourage other stakeholders in the office field (e.g., researchers, architects, building engineers, designers, building owners, facilities managers and others) to pursue new collaborations with each other, and with end-users or customers. It should facilitate workplace-related innovations and the exploration of further design opportunities.

This emphasis on collaboration gains extra relevance in relation to one of the main learning outcomes of the thesis, which is that designing flexible offices is highly complex due to the contextual and ramified character of the influences of design qualities in user experiences. The shared quality of many artefacts and spaces in flexible offices probably has the biggest systemic implications and is a reason to believe that designing flexible offices is a more challenging endeavour than designing traditional offices. This is something that stakeholders in the office field should consider for the planning, development, and operation of flexible office environments.

One legitimate question in regard to complexity would be ‘Can we isolate the cause(s) of a suboptimal experience?’ However, the findings suggest that precisely because these causes (design qualities and their influences) are interrelated, they should instead be contextualised instead. To this end, researchers and practitioners may benefit from mapping their data with the SEEX model, as it contributes to visualising how user experiences take place.

Another relevant question following the previous one would be ‘Can the causes of experiences at least be predicted and not only explained after the experiences?’ Prediction is a delicate concept in research of qualitative emphasis, but there are situations that may allow for and benefit from some kind of projection or anticipation of consequences in relation to identified patterns and trends observed across a number of cases. In this respect, the findings compiled in this thesis represent a starting point, a reference. From the UX perspective, projections not only concern appraisal patterns in relation to experiential outcomes. The users themselves can anticipate experiences based on their concerns, abilities, knowledge, and expectations of results/consequences, as well as in relation to learning processes (e.g., a new stimulus that is not new anymore after the first time it is appraised). Accordingly, the UX approach can bring a better foundation for designing flexible offices.



7. Conclusions

Different office designs provide the preconditions for distinct user experiences. The relatively recent popularisation of flexible offices represents a new paradigm in this regard, but the available literature suggests the need for further investigation on the interrelations between flexible office designs and user experiences at work. Anchored in the user-centred design tradition and drawing on a UX theoretical angle, this thesis investigates the influences that the design qualities of the artefacts and spaces in flexible offices have on the user experiences, and the design implications and opportunities derived from the outcomes of such influences.

According to the UX frame of reference adopted in this thesis, user experiences have a narrower scope than experiences in general, as these derive from the interaction with a system (i.e., an artefact, service, or a constellation thereof). These experiences can only be understood in relation to the user who experiences them and can be explained as a continuous cyclical process involving

- (i) the anticipated, perceived, or remembered event of use of a system in a context (stimuli),
- (ii) the user appraisal of its significance for her/his own well-being in relation to her/his concerns, abilities, knowledge, and expectations (evaluation)
- (iii) and the affective, expressive, physiological, and behavioural responses that may result from the appraisal (experiential outcome).

In this regard, the strategy was to capture rich insights into the user appraisal of the systems in use (office artefact, space, or constellations of them) and the experiential outcomes elicited by these. The research approach prioritised the collection of qualitative first-hand data and the acquisition of knowledge through multiple case studies. Utilising acquired knowledge to gain a deeper understanding of the research problem was also a relevant part of the thesis. The findings'

highlights and the contributions of the thesis are summarised in the two subsections below.

7.1. Findings' highlights

- Flexible offices are highly complex systems, where multiple users interact with multiple devices, resulting in both individual and collective user experiences.
- User experiences with flexible offices are influenced by interrelated design qualities of the spaces and artefacts in use, rather than by isolated qualities.
- Positive and negative influences were identified across studies in relation to a number of design qualities: (i) new offices and aesthetic of interiors, (ii) diversity of spaces and functions, (iii) openness vs. seclusion of spaces, (iv) flexible office arrangement for flexible use, (v) shared vs. assigned workstations, (vi) ergonomics of furniture and accessories, (vii) automated systems for climate, blinds, and lighting, (viii) other qualities characterising underused settings.
- These influences resulted in experiential outcomes (experiences of community, autonomy, purpose, control over the environment, and pleasure) from which several design implications have been drawn in Chapter 4. These are implications to consider for improving the user experience with flexible offices.
- The subjective nature of user experiences and the case-specific differences between offices indicates that designing for positive experiences with flexible offices is a challenging endeavour that requires rich knowledge of the users and their context.
- The particularities of flexible offices and specifically the systemic implications of shared constellations of artefacts and spaces suggest that designing flexible offices is more complex than designing traditional open-plan and cell offices.
- Designing for positive user experiences with flexible offices benefits from: (i) collaborations between stakeholders involved in the office planning, development, operation, and evaluation, and (ii) confronting and iterating conceptual ideas with users in relation to the user experiences that such conceptual ideas enable.

7.2. Thesis contributions

The research approach chapter describes three stages of my doctoral studies, more specifically knowledge acquisition, knowledge utilisation, and theoretical developments, which reflect the three contributions that my thesis makes to design research and practice.

The **first contribution** of this thesis is **knowledge of the experiences that users have with their flexible offices**. Approaching office user studies from different angles allowed me to gain a rich understanding of the influences that the design qualities of spaces and artefacts in flexible offices have on users' experiences at work. I acknowledge that the thesis is not the first (and will not be the last) in contributing to the understanding of office-related experiences. However, the UX angle adopted in the thesis is rather new in the study of offices and brings a diversity of methods that are new or not common in the type of studies conducted. Hence, this thesis (i) builds on different theoretical backgrounds and existing literature with a novel interpretation, and (ii) contributes to expanding the body of research on both, literature on office user studies from a UX angle, and UX literature with studies on multi-user and multi-touchpoint user experiences.

The **second contribution** of this thesis concerns the **knowledge generated with the utilisation of knowledge** to draw design implications and explore design opportunities for positive experiences with flexible offices. The experiential outcomes identified in the office studies made it possible to draw design implications that can help improve the user experience with flexible offices. Exploring design opportunities in the collaborative project with the furniture manufacturer enabled bridging design research and practice, transforming findings into value, and materialising learnings into research prototypes tested with users. These activities altogether allowed me to generate further knowledge on how user experiences take place in a novel way.

Derived from these two contributions, I also argue that this thesis has a dual character, as the study of office user experiences starts with a 'research in design' approach and ends with a 'research through design' approach. This dual character in its contributions offers valuable inputs for both researchers and practitioners to continue studying office user experiences and explore design opportunities.

The **third contribution** of the thesis corresponds to the **theoretical developments** represented in the SEEX model. This tentative model is cross-disciplinary as it builds on well-being theories in positive psychology, the construct of appraisal processes in cognitive emotion psychology, and the socio-cultural approach of Activity Theory to human practices. Transferring and integrating this into a theoretical UX model has been a natural step in my research process that positioned my work in a moderately unexplored standpoint in the office context. SEEX not only contributes to mapping and structuring the study of user experiences but also to understanding how user experiences take place. In this sense, the thesis provides a new theoretical reference that is applicable to the office context and beyond, and consequently expands the state of the art.

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Publication A

Publication B

Publication C

Publication D

Publication E

Publication F

Publication G

