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A healthy office and healthy employees: a longitudinal case study with a salutogenic perspective in the context of the physical office environment

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ABSTRACT

This two-wave study (time lag of six months and two years post-relocation) investigated ways in which employees' perceptions of the office environment relate to their perceived health in the long term, drawing on the salutogenic approach to health and the sense of coherence theory (comprehensibility, manageability, and meaningfulness). A mixed-method approach was adopted. The data collection involved semi-structured interviews with employees, plus structured observations. The findings indicate that employees found the office environment less comprehensible and meaningful in Wave 2, while (somewhat) equally manageable. Comprehensibility was influenced by a lack of clear behavioural rules; manageability was influenced by a lack of control over the environment; and meaningfulness was influenced by social environment and lack of personalization. The contextual aspects of the office, including tasks, flexible working culture and the change processes were critical to these findings. This study has demonstrated that negative influences caused by poor design choices do not resolve themselves over time. When there is limited support for one component of sense of coherence, the initial observed benefits wear off and negative influences may spill over into other components. Therefore, office design should be approached with balanced attention to comprehensibility, manageability, and meaningfulness.

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Office; well-being; flexible office; salutogenic; health; sense of coherence

Introduction


Recent decades have seen increasing interest in studying the impact of office environment on health-related outcomes (cf. Clements-Croome, 2018; Jensen & van der Voordt, 2019). However, as revealed by recent literature reviews (Colenberg et al., 2020; Groen et al., 2018; Jensen & van der Voordt, 2019), most studies focus on alleviating the negative effects on employees while the health-promoting potential of office environments is overlooked. These are, for example, nature references as a means of recovering from stress or space personalization as a means of enhancing well-being (Colenberg et al., 2020).

While the health and well-being agenda within the corporate real estate focuses on flexible office concepts, predominantly with respect to short-term effects of relocation to a new office (cf. Appel-Meulenbroek et al., 2018; Engelen et al., 2019), we know little about what happens when we become habituated to the new office environment and the novelties wear off. And more

importantly: Are the health benefits of office environments permanent or do they fade away? This study investigates ways in which employees' perceptions of the office environment relate to their perceived health in the long term.

Studies on the influences of office environment on employee health in the long term are rare and discrepant. For instance, some have observed improvements in perceived health 15 months after relocation to an activity-based office (Meijer et al., 2009). Conversely, other studies observed declines in perceived health, well-being and performance in the long-term due to increased exposure to environmental stressors in open plan offices (Bergström et al., 2015; Brennan et al., 2002; Lamb & Kwok, 2016). Furthermore, most longitudinal studies focus on comparing employee perceptions pre-relocation and within the three to nine months after (e.g. Blok et al., 2009; Candido et al., 2019; Gerdenitsch et al., 2018; Rolfö et al., 2018) which may be enough time for employees to adjust to

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the new environment and capture novelties. According to Wijk et al. (2020), a follow-up after nine months may be too short, as they did not find any changes in health after a move to an activity-based office from multiple office types. Short-term evaluations are therefore not sufficient to give in-depth knowledge on how novelties are appropriated over time. Exceptions are Wohlers and Hertel (2018) and Haapakangas et al. (2019) who investigated the long-term effects of relocation to activity-based offices and found decreased satisfaction with communication. Both studies emphasized that the long-term effects of relocations may vary depending on follow-up time, previous office concept and differences between cases.

Hence, if the case-specific circumstances play an important role in explaining the observed discrepancies between studies, qualitative and in-depth research approaches appear as particularly relevant to further understand: (i) how and why initial perceptions evolve over time, and (ii) how the new routines or coping strategies remain or change. Nonetheless, a recent systematic literature review reporting on the influences of physical work environments on employee health and well-being evidenced that longitudinal studies with a qualitative approach are scarce (Berlin & Babapour Chafi, 2020).

Salutogenesis and sense of coherence

This paper adopts the conceptualization of health, proposed by Huber et al. (2011), as ‘the ability to adapt and to self-manage in the face of social, physical and emotional challenges’. This conceptualization was adopted because it is dynamic, and it emphasizes the resilience and capacity of people to cope with chronic disease. Moreover, it considers the opportunities for individuals’ health gains, rather than focusing on their ill health only. Huber’s conceptualization has received criticism as it is only applicable in circumstances wherein the individuals are in control, whereas some social conditions may prevent individuals and communities to adapt to their circumstances (Jambroes et al., 2016). Nevertheless, health in this conceptualization is regarded as a dynamic balance between opportunities and limitations influenced by social and environmental challenges (Huber et al., 2011). By effectively providing inclusive work environments, people who are less able to take care of their own health can work or participate in social activities and be part of society, despite limitations. Hence, this conceptualization is preferred over the definition of health by the World Health Organization (1948) as a state of ‘complete physical, mental and social well-being’ which has been often taken as a

reference, but also criticized for being overly idealistic, especially due to the word ‘complete’. The conceptualization by Huber et al. fits with this paper’s perspective on health as a dynamic concept on a health-ease and disease spectrum i.e. salutogenic approach.

Antonovsky (1979) coined the term salutogenesis to refer to a health approach that focuses on the factors promoting health, rather than on those causing illness. From this perspective, health and illness are not separate variables but the ends of a continuum and movement toward the health end is facilitated or hindered by competing forces (Eriksson & Lindström, 2006).

Seeking to answer the question: ‘why do some people stay healthy in stressful situations and others do not?’, Antonovsky (1979) developed the construct of ‘sense of coherence’, consisting of three interrelated components: comprehensibility, manageability and meaningfulness. This construct is framed in the salutogenic approach to health and refers to a person’s, a community’s or a society’s ability to overcome challenges by understanding the character of the problems (comprehensibility), identifying and deploying relevant resources (manageability) while finding the perceived problems as challenges worthy of investment and engagement (meaningfulness) (Antonovsky, 1987). Accordingly, the sense of coherence determines an individual’s ability to cope effectively with stressors and subsequently their position on the ‘health-ease’–‘dis-ease’ continuum (Eriksson & Lindström, 2006).

The movement toward the health end is facilitated by generalized resistance resources (salutogenic forces), which refer to the resources of a person, a group, or a community, such as education, material resources, knowledge, coping strategies and social support, and determine the strength of sense of coherence (Idan et al., 2016). The absence of resources can become a stressor and are characterized as generalized resistance deficits (pathogenic forces) (Antonovsky, 1987).

Studies indicate that the components of sense of coherence are health-promoting resources which may protect individuals from stress and reduce health risks (Eriksson & Lindström, 2006, 2007). Thus, people with a stronger sense of coherence adopt healthier behaviour and are more motivated to cope with stressors, thereby becoming more resilient with better perceived health and quality of life (Braun-Lewensohn et al., 2016; Eriksson & Lindström, 2007; Idan et al., 2017; Koelen et al., 2016). Moreover, a resourceful working environment helps employees build up sense of coherence, thus leading to greater work engagement (Vogt et al., 2016).

Health is developed through the interaction between individuals, their individual health determinants, and

their relevant living environments (Bauer & Jenny, 2016). Accordingly, organizations can be considered a living environment and thus a significant contributor to both pathogenic and salutogenic health development. In that sense, the organizational structure, strategy and culture interact with individual competence, motivation and identity to influence health (Bauer & Jenny, 2016). Hence, health in an office context becomes relevant when studying individual health developments.

Sense of coherence in the office context

This study focuses on the physical office environment which encompasses every material object and stimulus that people encounter in their work, such as building design, room size and layout, furnishings, material and equipment, plus indoor environmental quality such as noise, lighting or air quality (Davis et al., 2011; Sander et al., 2019). The components of sense of coherence are further described and interpreted with respect to the office context (summarized in Figure 1).

Comprehensibility

Comprehensibility in the work environment is the capacity to understand and negotiate the contexts in which we find ourselves (Golembiewski, 2016). Wayfinding is an architectural feature that has important implications for a person's stress and anxiety levels and effectiveness in coping (Danko et al., 1990). People tend to use landmarks, boundaries, nodes, and colours to understand and navigate in buildings (Oseland, 2009). Hence, a comprehensible space has cues and

signs and is psychologically accessible. Moreover, comprehensibility relates to behavioural rules that are often necessary for structure and predictability. Involving users in the design process and making rules more explicit may result in increased acceptance and greater compliance (Rolfö, 2018). Comprehensibility also refers to environments that communicate their intended use and differences between different workspaces types by, say, colour-coding or using different materials and furniture for each type. Finally, when a relocation takes place, it is often unclear to employees what a change in the work environment will mean for them. Transparency and predictability are necessary during a change process perhaps by giving early and ongoing information about the change and its results (Kämpf-Dern & Konkol, 2017; Lahtinen et al., 2015). Hence, office environment comprehensibility may be fostered through:

- ease of wayfinding,
- clear behavioural rules,
- easy-to-understand environments,
- transparent information sharing.

Manageability

At work, manageability reflects the feeling that a person is in control of their environment and work. A sense of control may refer to freedom of choice in perceiving visual and acoustic stimuli, plus isolation from unwanted observation and background noise (called 'visual and acoustic privacy') (Kupritz, 1998; Van Der Voordt et al., 1997). Another form of control is

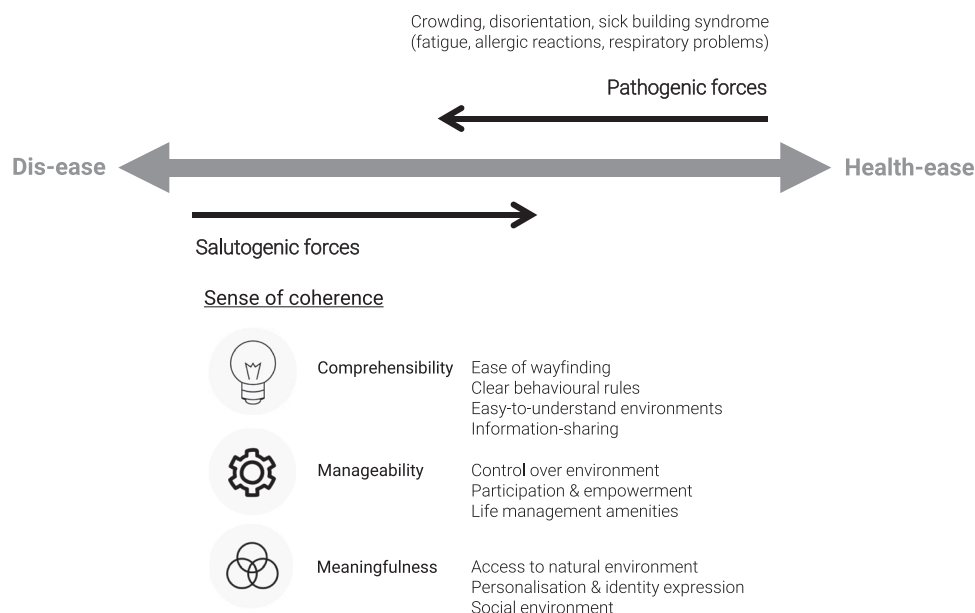


Figure 1. The sense of coherence framework in the context of physical office environment.

empowerment by increasing employee opportunities to participate in the decision-making process (Vischer, 2008). It has also been suggested that the feeling of empowerment impacts the sense of belonging or ownership over the employee's workspace (Vischer, 2008). Finally, resources that help employees manage work and home pressures represent important stress relief and mental relaxation outlets. These cover a wide array of services, such as childcare or work autonomy (Danko et al., 1990). Therefore, manageability in the context of an office environment may apply to:

- a sense of control over one's surroundings (such as tools, resources and stimuli),
- participation and empowerment,
- life management amenities.

Meaningfulness

Meaningfulness in the work environment refers to the extent to which one feels that the stressors of that environment are worthy of investment and engagement (Antonovsky, 1993). Factors that evoke meaning in an office environment may include colours, materials, art and elements of the natural environment, such as daylight, indoor plants, views and/or access to the natural landscape. It is suggested that humans have an innate tendency to seek connections with nature and other forms of life, and that nature contact is linked with health and well-being benefits (Wilson, 1984). Thus, nature references in office environments can be seen as a salutogenic resource that renders meaning to office environments by integrating other forms of life. Moreover, personalization is another form of affording meaning to space. This may lead to 'place attachment'; the emotional bonds between people and their physical environment, including personal space or valued items and facilities (Inalhan & Finch, 2004). Artefacts and symbols of cultural and group identity are examples of meaningful resources which may promote a collective sense of meaning (Heerwagen et al., 1995). Similarly, meaning is found in social relations. The physical layout of the office influences patterns of social interaction. It thereby shapes the social and relational aspects of work, as it facilitates or restricts with whom and how often one interacts (Davis et al., 2011). In an office environment meaning may be fostered through:

- integration of the elements of the natural environment,
- personalization,
- social relations.

The salutogenic approach has received little attention in the research on the built environment, specifically in the office context. Few studies have applied salutogenesis to healthcare building design (Golembiewski, 2010; Golembiewski, 2016) and there is a growing interest in its application in the office context. From a salutogenic perspective, Roskams and Haynes (2019) proposed a conceptual framework in which environmental demands and resources such as behavioural rules, opportunities for personal identity expression, and biophilic design solutions were suggested to influence sense of coherence. Ruohomäki et al. (2015) related sense of coherence to office relocation, but no explicit relation was made to the physical environment. Similarly, a recent case study investigated indicators of sense of coherence during relocation to an activity-based office with a two-wave questionnaire and focus group interviews (Wijk et al., 2020). The study showed that meaningfulness, manageability, and comprehensibility, significantly increased from baseline to nine months post-relocation, given that the implementation process facilitates sense of coherence with support, tools on how to work in an activity-based office, and clear communication.

However, there is a lack of studies that identify features of office environments important to employees' sense of coherence in the long term. An increased knowledge about the salutogenic aspects can help providing evidence for design and management suggestions. To address this knowledge gap, this paper aims to investigate ways in which employees' perceptions of the office environment relate to their sense of coherence in the long term. The research question is:

- What are the short-lived and long-lasting interrelations between employees' perceptions of the office environment and their sense of coherence?

Study design

A case-study approach was adopted in two waves (six months and two years post-relocation) to investigate ways in which employees' perceptions of the office environment relate to their sense of coherence in the long term.

The case study concerned relocation from cell offices to a combi office. In combi offices, individual workstations are combined with back-up spaces to support work activities that are not suitable at the personal workstations, such as quiet rooms for concentrative work, phone booths for calls, meeting spaces for collaborations, etc. (Bodin Danielsson & Bodin, 2008). A key difference between a combi office and an activity-based

office is that combi offices have assigned desks (instead of shared desks), which results in a different office experience, as well as added floor area per employee and eventually higher costs. The case was selected due to the relocation from cell to combi offices, which few studies have investigated, especially in the long term.

Data collection involved individual semi-structured interviews and structured observations of the office environment. To allow for comparisons between the two study waves, the authors replicated the methods and the convergent-parallel design from Wave 1, i.e. data was collected by different methods in parallel, analysed separately and findings were compared, contrasted and integrated (cf. Creswell, 2014) as displayed in Figure 2. The preliminary results were presented to the studied division of employees in order to gather additional feedback and confirmation. The comparison between the first and second study waves enabled to gain a deeper understanding of the short- and long-term influences of the office environment on employees' perceptions. The results from Wave 1 have been published in Cobaleda-Cordero et al. (2019).

Context

The case concerns a division of employees at a Swedish university department that had relocated in August 2017 from cell offices to a combi office in a renovated building with 10 other divisions.

The three upper floors of the six-storey building were allocated to university staff, with the rest excluded from the study as it mostly served educational purposes and other services. The employees had assigned desks on the fourth floor, in rooms shared by either two or eight employees. All the office rooms had homogeneous conditions in terms of e.g. type of furniture, technical equipment, glass partitions, daylight, and temperature. Only minor differences were observed regarding, for

example, perceptions of privacy, that related to the position of the workstations within the rooms. Back-up spaces included meeting rooms, phone booths, quiet rooms, flexible rooms, breakout areas and balconies, most of which faced a central atrium (Figure 3). Employees had access to all shared facilities in the building. Some modifications had been applied to the office interior by the facility management since Wave 1:

- (i) A quiet room with couches was turned into a shared office room due to a lack of workstations.
- (ii) A windowless meeting room (barely observed in use during Wave 1) was turned into a printing room, following complaints about the lack of printers.
- (iii) Curtains were added to rooms facing the staircases to enhance visual seclusion following spontaneous interventions by employees who, for example, covered the glass walls with paper.
- (iv) Couches in the lunchroom were moved to the other breakout areas and replaced with more dining tables and chairs to accommodate more employees during lunch.

Data collection procedure

The data collection involved individual semi-structured interviews and structured observations, using the same data collection protocols in both waves. As there was positive feedback from the division and participants after Wave 1, the second study was extended to the whole department, including all 10 divisions. However, for the sake of comparability between Waves 1 and 2 in this paper, only the results from the division in the first study are reported here. Invitations to participate in interviews went out to all division employees. In Wave 1, 16 employees volunteered to participate in the study, out of which 11 volunteered for Wave 2 and 2 had left

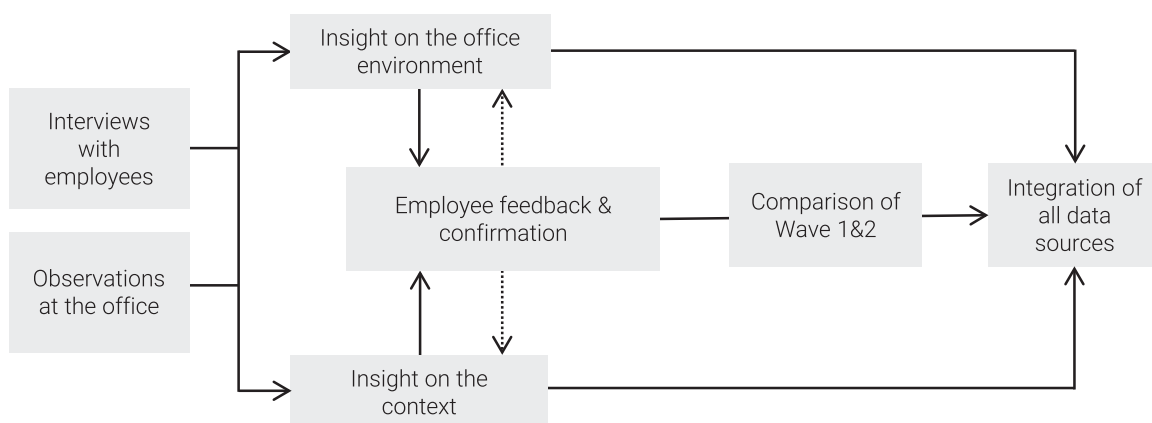


Figure 2. Research design.

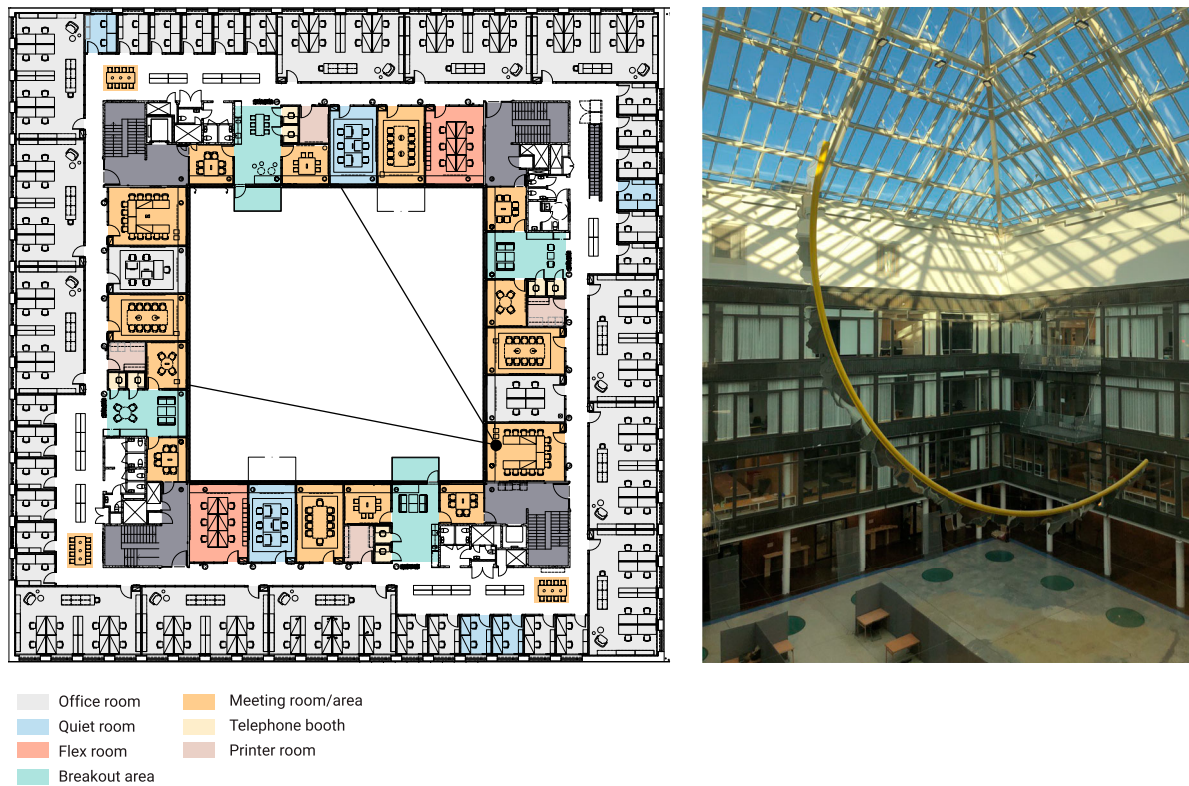


Figure 3. Picture and representative floorplan of the office studied.

the organization at the time of the second study due to the ending of contract/research projects. The temporality of research contracts causes a moderate rotation of personnel in the organization by default, thus, to preserve a sample that was representative of the division population as it was in Wave 2, six additional employees who volunteered for Wave 2 were included; three had experienced the previous office and the other three had been working in the organization for about or less than one year in new projects (Table 1).

All the data were collected by the second and first author in Waves 1 and 2 respectively. Prior to the follow-up study (Wave 2), the authors held several discussions to ensure that the data collection was conducted in the same way. The discussions concerned information and techniques on how to guide the interviewees throughout the interviews, formulate the questions, introduce the mediation tools in the interviews, as well as how to plan the observations routes and avoid disrupting employees' routines. This was followed by a practice interview that the first author conducted with the second author and a test of the observation protocols. The questions addressing the relocation process in Wave 1 were adapted to Wave 2, to focus instead on employees' perceptions and involvement in decisions concerning modifications in the office over time. For instance, the question about degree of involvement in

the relocation process was changed to the degree of involvement in the post-relocation modifications (see examples in Appendix).

A card-sorting exercise plus floorplan drawings, markers and sticky notes were used as mediation tools during the interviews. The card-sorting exercise consisted of a biaxial chart visualizing levels of satisfaction and importance, and a set of cards relating to predefined

Table 1. Interviewees' demographics and job positions.

Relocation	Wave 1	Wave 2
August 2017	Six months after	Two years after
No. of division employees	Total = 36 Female = 20.5% Male = 79.5%	Total = 35 Female = 22.8% Male = 77.1%
No. of interviewees	Total = 16 Female = 31.2% Male = 68.8%	Total = 17 Female = 29.4% Male = 70.5%
Researcher	11	9
Professor/Lecturer	4	4
Project assistant	1	0
Other categories (e.g. project manager, admin.)	0	4
Time working in the organization	Total = 16 0–1 years = 18.7 % 2–5 years = 62.5 % 6 > years = 18.7 %	Total = 17 0–1 years = 17.6 % 2–5 years = 41.1 % 6 > years = 41.1 %
Interviewees participating in both study waves	11	
Interviewees participating in one study wave only	5	6
Interviewees' median age	31.5 years	34 years

themes to be sorted on the chart. The themes covered office environment features such as daylight, personal storage or visual privacy, and contextual aspects such as job conditions, activities, etc. The participants were asked to sort the cards one by one while motivating their choice. Blank cards were also available at the end in case the participants wanted to contribute with new themes. The drawings, markers and notes were used to help interviewees elaborating on their explanations, note the spaces used for their routines, or signal relevant aspects from these. The interviews averaged an hour and were audio recorded. The questions were designed to enable interviewees to share their insights on how they experienced the office, their activities and preferences, and contextual socio-organizational aspects. For instance, the question ‘are there any rules or agreements between colleagues on how to use the different office zones depending on your activity?’ to investigate structure and predictability in the office. Follow-up questions were asked depending on the answers:

- (If yes) Are those rules respected?
- (If no) Do you wish to have them?

The observations in the office involved structured observations, i.e. rounds were conducted according to a systematic plan and employees were aware of the observer. A total number of 19 rounds were conducted in Wave 1 by the second author of this paper and 18 rounds in Wave 2 by the first author. In both waves, the rounds were scheduled along two weeks and across four intervals (8:00–10:00, 10:00–12:00, 13:00–15:00, 15:00–17:00), according to the availability of the observer and avoiding events such as a monthly division meeting that were not part of the daily routine and caused abnormal occupancy rates. The goal was to cover the equivalent of a regular Monday-to-Friday working week. Each round involved walking a pre-defined route covering all the workstations, back-up spaces and breakout areas taking structured field notes and blueprint annotations as well as pictures. The field notes involved for example, workstations and back-up spaces in use, number of employees per space, available facilities and equipment, activity patterns and flows of people between spaces, or whether different spaces were organized and in order.

Data handling complied with the General Data Protection Regulation, assuring interviewees of their right to request access to their notes. Interviewee names were coded, and their data aggregated. Preliminary findings from the analysis were presented during a seminar in the division to get feedback and confirmation.

Data analysis procedure

The interviews were transcribed and coded using NVivo 12. An abductive approach was adopted to analyse the content that is defined as a ‘creative inferential process’ combining an inductive and deductive approach, i.e. using empirical data and theoretical prepositions in a dialogical process for analysing qualitative data (Timmermans & Tavory, 2012). In step 1, the interview transcripts were analysed to identify recurring themes related to perceptions of the physical office environment and contextual aspects regarding organization, activities, and individual preferences (see examples in Table 2). This led to identifying recurring positive and negative perceptions. For instance, 17 interviewees in Wave 2 referred to lack of cleanliness and individual responsibility in 27 instances. In a further round of coding in the second step, the codes (perceptions) were related to office environment features from the sense of coherence framework. For instance, ‘too much transparency due to glass partitions’ was related to ‘exposure to visual stimuli and lack of control’. This step was followed by a deductive coding process in step 3, in which the office environment features were related to the components of sense of coherence. These were comprehensibility [C], manageability [M] and meaningfulness [ME]. In the previous example, the ‘exposure to visual stimuli’ was related to manageability due to the lack of control over the stimuli.

The first two authors resolved to code the transcription of one interview separately to discuss and develop a consistent coding strategy. The few differences were discussed until full agreement was reached. Further, during the process, the three authors regularly discussed the analysis, wave comparisons and reporting strategy.

Furthermore, data from the observations was analysed to support and complement the findings from the interviews. This involved reviewing and summarizing observation field notes and occupancy data. Occupancy was calculated for office rooms, based on the percentage of workstations occupied with respect to the maximum number of workstations. Utilization was calculated for back-up spaces, based on the percentage of times the spaces were observed in use, of the total number of 18 and 19 observations in Waves 1 and 2 respectively. The findings from observations were compared with the interviewees’ insights in the analysis.

The longitudinal analysis followed a convergent-parallel design, in which the two separate datasets from each wave were analysed independently and brought together during the interpretation (cf. Creswell, 2014). That is, the findings were contrasted with the reasons extracted from both waves, to capture changes in the

Table 2. Examples of deductive coding process.

Excerpt	Step 1 Perceptions of the office environment	Step 2 Office environment feature	Step 3 Sense of coherence components
'[I am] slightly dissatisfied with it [cleaning] maybe, but that's perhaps because we have colleagues who don't put things in the dishwasher and that's a problem' (I07-W2)	<ul style="list-style-type: none"> Cleanliness and visual clutter Individual responsibilities 	Behavioural rules	Comprehensibility
'Since I don't go anywhere, I sit at my desk, so I just avoid seeing anyone who is going. I know people are going because [...] it's a 360-degree kind (at least 270 degree) view. So, you can't avoid knowing that someone is going' (I20-W2)	<ul style="list-style-type: none"> Too much transparency due to glass partitions 	Exposure to visual stimuli and lack of control	Manageability
'The social atmosphere is much, much better. [...] You see more people and friends and start talking with them' (I3-W1)	<ul style="list-style-type: none"> Easy to meet people thanks to the spatial transparency 	Social interactions	Meaningfulness

way various features were perceived over time and how they related to the sense of coherence framework presented in the findings section.

Findings

In general, participants had a more positive perception of the office environment in Wave 1. The quantity and design features of new facilities (such as openness, brightness, aesthetics) resulted in greater motivation, a stronger sense of belonging, more energy and better social integration at a division level. However, in Wave 2, many of the positive influences of, say, social atmosphere and aesthetics deteriorated. This resulted in lower levels of group cohesion and feelings of isolation. Additionally, most of the negative influences on sense of coherence remained unresolved. These included exposure to visual and acoustic distractions and lack of control over environmental stimuli which reduced manageability in the office.

The findings are presented in three sections: (i) long-lasting influences, (ii) short-lived influences of the office environment, and (iii) the contextual aspects the authors found relevant to better understand why office environment influenced interviewees' sense of coherence as it did.

Long-lasting influences on employees' sense of coherence

In general, several office environment features were found to have the same influence on employees' sense of coherence in both waves (Figure 4). These features included aspects that positively influenced manageability and meaningfulness, including meeting rooms and breakout areas. *Meeting rooms* were deemed available, diverse in size, equipped with good information and communications technology coverage and furniture

and in proximity to employees' own workstations and territory. That said, the observation data showed rather low occupancy rates, for meeting rooms for four to six people (30.3% in Wave 1), which remained almost at the same level (Table 3). Similarly, the *breakout areas* were perceived as diverse in size and type. In particular, the balconies were among the most popular spaces in breakout areas, as they offered a bright, relaxing environment with access to different views: 'It's a change of scenery there, you see the sky, you see people strolling by downstairs in the yard and you can sit down there and have a coffee, stretch your legs and talk' (I13-W2).

The interviewees appreciated the amount of *daylight* in Wave 1, thanks to the large windows, glass partitions and use of light colours. Similarly, in Wave 2, the amount of daylight had a positive influence on meaningfulness by creating a positive mood for 11/17 interviewees: 'I think it affects everybody's mood in one way or another. [It is] very important and [I am] satisfied' (I01-W2). However, the (malfunctioning of) automated shades and the limited control over this feature had a negative influence on manageability for 6/17 interviewees: 'There is a good amount of daylight, but the sunshade usually blocks it and often we're forced to use artificial lighting' (I15-W2).

The *workspace personalization* had conflicting influences on employees. While the organization had discouraged any personalization, pre-relocation, almost one-third of interviewees had a positive perception of the current arrangement: 'I have the possibility [to personalise my workspace], so even though they say we shouldn't, I did it anyway' (I06-W1). Conversely, others perceived a lack of opportunity to personalize their workspace as limiting and less meaningful: 'Our office is quite empty [...] it makes it less personal I think' (I13-W2).

The office space offered low levels of spatial seclusion for office rooms and back-up spaces, thanks to

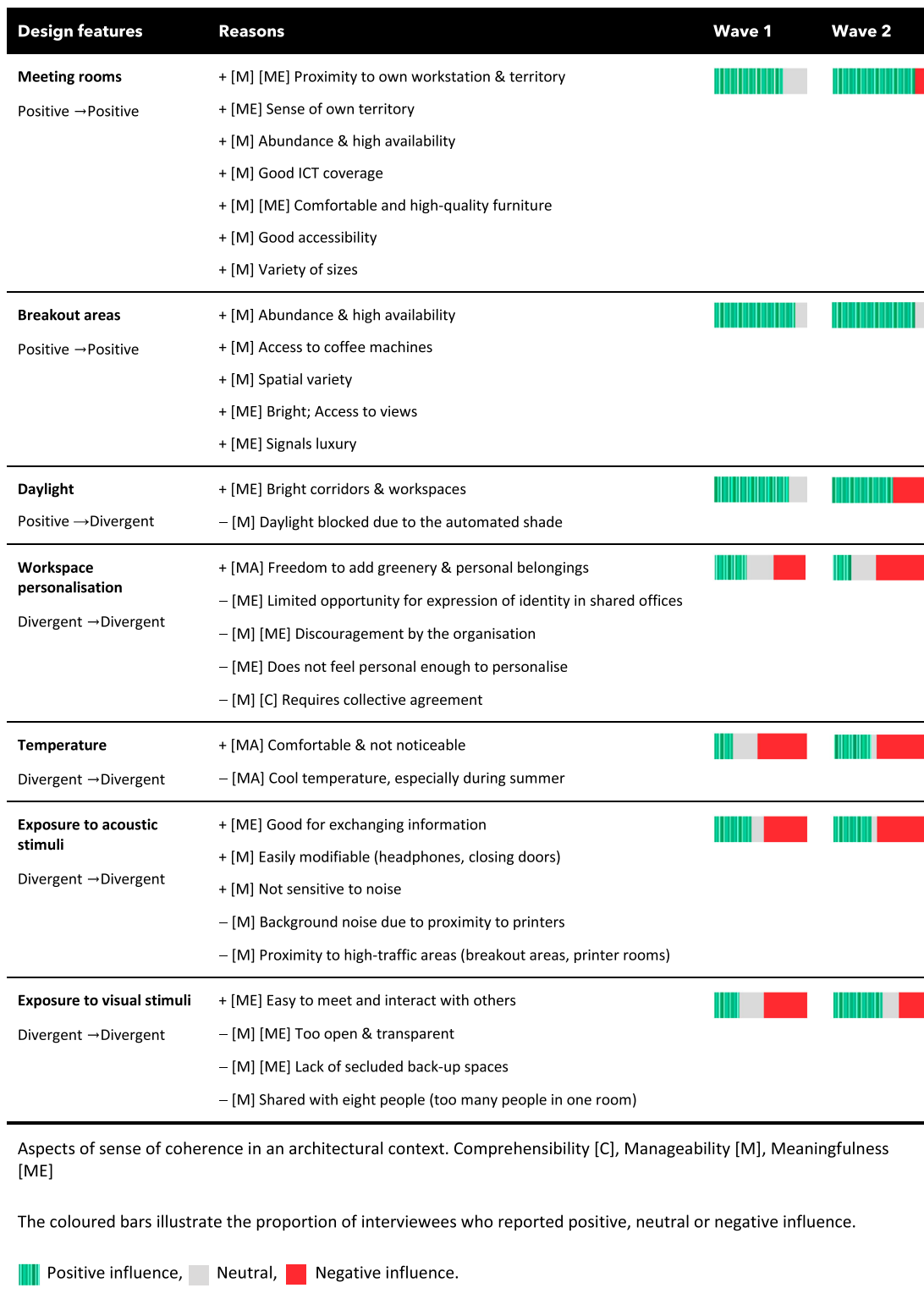


Figure 4. Long-lasting influences on employees' sense of coherence.

the large glass partitions and windows. This limited control over *visual and acoustic stimuli*. Specifically, some interviewees found it difficult to manage the visual stimuli:

what disturbs me the most is the big windows towards the corridors. It's completely open. It's not that I mind people passing by but, every time someone does, without being fully aware of it I turn my head and look up. (I13-W2)

Table 3. Occupancy during a working week.

	Wave 1 (%)	Wave 2 (%)
<i>Avg. occupancy</i> ^a		
Office rooms	31.4	32
<i>Avg. utilization</i> ^b		
Meeting rooms 4–6p	30.3	25
Meeting rooms +6p	26.3	23.1
Quiet room with sofa	15.8	–
Quiet rooms with 2p	13.7	30.5
Quiet rooms with 6p	0	38.8
Flex room	44.7	66.6
Phone booths	6.6	13.1
Breakout areas	23.7	19.4
Lunchroom – 5th floor	94.4	88.8

^aPercentage of workstations occupied with respect to maximum number of workstations.

^bPercentage of times the spaces were observed in use of the total number of 19 and 18 observations in Waves 1 and 2 respectively.

In contrast, the openness increased the chances for social encounters, and it was perceived as ‘good for exchanging information’ (I05-W2). This had a positive influence on the meaningfulness of the environment.

The indoor *temperature* was perceived as cold by nearly half of interviewees, and the impossibility to adjust the automated climate system limited their sense of manageability: ‘I would benefit from [...] more possibilities to change the environment around me, like affecting the temperature’ (I13-W2). The low temperature was particularly disturbing in the summer-time due to people wearing light clothing.

Short-lived influences in employees’ sense of coherence

Several design features of the office environment had short-term influences on interviewees’ sense of coherence and are presented as positive and negative changes (Figure 5).

Positive changes

Some interviewees in Wave 1 found *personal storage* insufficient while others were satisfied. However, in Wave 2, personal storage helped managing one’s personal belonging in the office for the majority (13/17): ‘There’s more than enough space for me to store my stuff. It’s accessible just by my workstation’ (I02-W2). Two interviewees remained dissatisfied with storage and perceived a lack of space. Another positive change was regarding the *furniture* that was perceived as more meaningful, signalling luxury and status: ‘I also like the fancy meeting room [...] it feels luxurious’ (I16-W2). Furthermore, the functions and quality of the furniture had a more positive influence on manageability in Wave 2: ‘I appreciate the fact those tables can

go up and down, I can stand for a while [...] and the chair’s comfortable’ (I19-W2).

Negative changes

Some of the positive features identified in Wave 1 were not appreciated in Wave 2. These included social interactions, aesthetics, spatial diversity, and (lack of a) sense of control and behavioural rules in the office. Each of these changes are described below.

The *social atmosphere and interactions* were appreciated in Wave 1:

social atmosphere is much, much, better than the previous one [...] because here, when you go to the coffee areas, you see more people and friends and start talking with them. I like it much more than the previous one.

(I03-W1)

However, in Wave 2, almost two-thirds of interviewees (10/17) expressed difficulty in meeting colleagues for coffee breaks. This was due to the office layout and abundance of space which spread people around, plus the limited capacity of most breakout areas: ‘We are more spread out in the division and I think that’s the most obvious drawback of the social atmosphere than before’ (I13-W2). The reasons also related to the lack of a division-specific space as a centralized meeting point:

It was nice when someone could say ‘I brought birthday cake’ and you had it all day or when people sent postcards and you put them up. You had your own space. I thought that was nice. Now, there’s a lot of subgroups and we don’t have just the one place to go.

(I06-W2)

The reduced opportunities for social interactions created a feeling of isolation, and thus the office environment was perceived less meaningful: ‘You’re left there [in the office] and somehow forgotten [...] it’s just a general feeling of isolation. That maybe in the long term can’t be so good’ (I19-W2).

The *aesthetics* of the office design was associated with positive meanings for the majority in Wave 1, for being pleasurable and making them feel appreciated: ‘It looks more modern, feels like you’re treated as important if you work in a nice place’ (I05-W1). In Wave 2, some interviewees appreciated the minimal look while others found it less meaningful and described it as ‘sterile’, ‘boring’, and ‘homogenous’: ‘There are only very boring colours in here [the office]. Some plants with flowers would be nice. We need more colours!’ (I18-W2). The observation data showed that the space became cluttered over time, with papers and books lying around on storage cupboards in the middle of corridors.

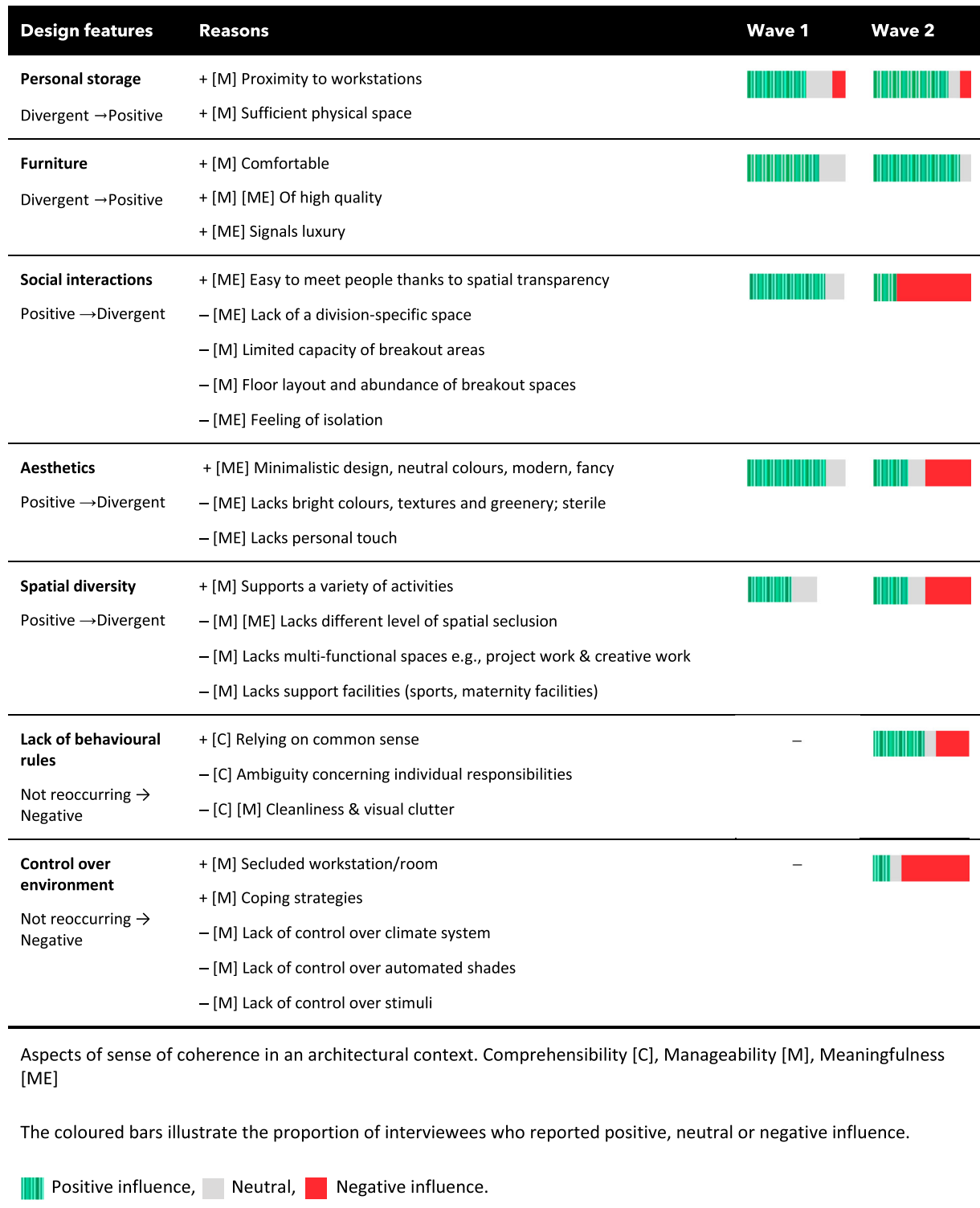


Figure 5. Short-lived influences on employees' sense of coherence.

Figure 5. Short-lived influences on employees' sense of coherence.

The *spatial diversity* provided choice to match one's activities with a variety of spaces and this was perceived as more manageable in Wave 1: 'We have space for different types of meetings. We have a fancier one to have clients and some with video projectors ... so I

think we have flexibility. I haven't found a space that didn't match my work situation' (I01-W1). However, in Wave 2, nearly half the interviewees found the office less supportive of individual, or project work: 'I would like access to a room where I can spread things

out and work more visually' (I06-W2). Furthermore, the homogeneity of visual and acoustic seclusion in back-up spaces limited control over distractions and consequently reduced manageability.

The limited opportunities to *control* temperature, automated shades and stimuli (raised as an issue in Wave 1) reduced office manageability in the follow-up wave. The automated climate system did not allow personal adjustments, given that the temperature was perceived as cold by nearly half the interviewees (8/17). Similarly, the lack of control over automated shades was regarded as limiting and uncomfortable (9/17): 'It's really terrible that you don't get any personal say in whether you want it [shades] up or down' (I12-W2). In terms of exposure to visual and acoustic stimuli, opinions varied among employees depending on personal preferences, workstation position and room locations. Four interviewees who were dissatisfied with the lack of privacy and exposure to stimuli in Wave 1, had changed workstation position or offices to a more protected location. Hence, the various levels of workstation seclusion and coping strategies (such as noise-cancelling headphones or desk dividers) supported concentration for some: 'When I put my headphones on and the wall [divider] up, that [concentration] is absolutely no problem' (I02-W2). Whereas others were dissatisfied: 'To me, my environment includes a glass wall and window which I obviously can't control. I can't control visual distractions, nor can I control noise' (I16-W2).

Some interviewees were satisfied with the lack of *behavioural rules*, and relied on common sense: 'With time, you sort of develop informal rules anyway, dependent on the group or room' (I13-W2). However, the uncertainty and confusion over individual responsibilities made the office environment less comprehensible for others and subsequently led to feelings of frustration towards colleagues: 'The kitchen is dirty and there are so few people who feel responsible for its cleanliness. This makes me feel "urgh"' (I17-W2). Although signs were put up, these were not complied with, leading to visual clutter and mess, as apparent in the observations. That said, an 'in-house guidebook' had been shared with employees during the 2017 relocation, with practical information on space use and etiquette in the work environment. However, the book had not been updated since and was never mentioned by the interviewees.

Contextual aspects

The underlying explanation for the changed perceptions was, to some extent, associated with the contextual aspects of the office, including organizational working

culture, facility management strategies/processes, activity patterns and individual preferences influencing different components of sense of coherence (Figure 6).

Organizational aspects

The organization had a trust-based working model in which employees were free to choose when and where to work. A large number of interviewees (13/17) greatly valued their high level of autonomy, regarding it as beneficial to their work-life management. For example, to improve concentration, some employees chose to work remotely or avoid peak hours in the office by coming in early. Regarding the facility management strategies/processes, interviewees did not feel involved in the change process, either before or after the relocation. Interviewees perceived that their participation in the process was more of a formality, as their opinions were disregarded and their ability to influence changes was limited. Subsequently, this had a negative influence on the manageability and meaningfulness of the office environment. Furthermore, the post-relocation interventions, such as installing curtains for some offices to cover glass partitions were implemented with neither communication nor involvement of the employees. Also, over one-third of the interviewees perceived the maintenance as unresponsive to fault reports concerning the automated shades. This led to ambiguity and confusion about follow-up processes and hence reduced comprehensibility.

Task-related considerations

The choice of work setting, and resources were partly influenced by the activity patterns of the interviewees. Nearly half of interviewees in Wave 2 indicated a rather low task variety mainly conducted at their workstations. Also, a few employees' tasks required more interaction with others which would occasionally disturb colleagues in the same office. The task-related differences among the participants led to divergent perceptions of office manageability.

Individual aspects

The preferences varied among interviewees. Some interviewees indicated that they were more adaptable and/or less sensitive to stimuli and some had experienced better or worse conditions in their former workplaces which influenced their expectations of the current office. Also, over two-thirds of interviewees preferred their workstations for most of their activities over the back-up spaces due to dual screens, personal storage and belongings in proximity, privacy and the implied sense of ownership. Therefore, most interviewees preferred to modify their workstations by adopting coping

Contextual aspects	Reasons
Organisation-related	+ [M] High level of autonomy – [C][M] Low level of user involvement – [C] Lack of responsiveness to faulty reports
Individual-related	± [M] [C] Personal preferences ± [M] Previous experiences
Task-related	± [M] Task variety ± [M] Level of interaction
Aspects of sense of coherence in an architectural context. Comprehensibility [C], Manageability [M], Meaningfulness [ME]	

Figure 6. Influence of contextual factors on employees' sense of coherence.

strategies to concentrate better. This may explain the low occupancy of back-up spaces (Table 3). Hence, the adaptation strategies indicate that the interviewees understood the potentials and shortcomings of the office environment (comprehensibility) and identified ways to craft a better working environment (manageability).

Discussions and conclusions

This paper has aimed to investigate ways in which employees' perceptions of the office environment relate to their sense of coherence in the long term. The contextual aspects of the office, including organizational culture, facility management strategies/processes, activity patterns and individual preferences were critical to these findings. The findings about the office environment are discussed in relation to sense of coherence. Additionally, methodological concerns and future research as well as concluding remarks are addressed.

Office environment in relation to sense of coherence

The findings show that employees found the office equally manageable in both waves, as the lacking sense of control over the environment was compensated by a high level of autonomy. Previous studies have associated autonomy with a positive impact on well-being, job satisfaction and work motivation (Deci & Ryan, 2008; Gagné et al., 1997; Ilardi et al., 1993). Improving control options (e.g. curtains and screens for privacy and extra heaters for better temperature) may resolve some of the issues. Concerning automated shades, future studies may investigate whether smart (automated) technologies would lead to energy gains or compromised user experience and a resulting performance gap.

The employees found the office environment less meaningful in terms of social interactions compared to the first wave. The identified difficulties in the social work environment contradict previous studies that show a positive influence on social relations and communication in open and shared work environments (Bernstein & Turban, 2018, see literature review by Engelen et al., 2019). Among longitudinal studies, the findings are inconsistent. While Gerdenitsch et al. (2018) show that improvements in communication remained stable between the first and second measurement, Haapakangas et al. (2019) report a decrease in satisfaction with communication and the sense of belonging, 3 and 12 months post-relocation, which our findings also confirm. A possible reason for this finding could be that the results on social relations in Wave 1 were positively influenced by a novelty effect of relocating from cell offices to shared rooms, and/or the increase in spaces for breaks (Gerdenitsch et al., 2018). Over time, the accumulated negative influence of noise and visual distractions may have outweighed the initial positive experience. Future studies may investigate whether these changes mainly relate to novelty effects or if it would be different, for example, between organizations with different needs for collaboration and task interdependency. Other possible explanations could be that employees may have experienced a drift from their old group of colleagues in Wave 2 as a result of the relocation and organizational merger. Organizations should be prepared to solve possible difficulties in socialization and group cohesion in flexible offices, for example, with the help of scheduled coffee breaks and an allocated space.

The lack of opportunities for the personalization of workspaces found in this case reduced the sense of ownership, and eventually meaningfulness. Other studies have highlighted the importance of personalization of space as a means of making sense of the environment

and giving meaning to the workspace (Brunia & Hartjes-Gosselink, 2009). Furthermore, the negative change regarding the aesthetic design can be attributed to the initial novelty that faded away due to the reduced sense of ownership. Golembiewski (2010) indicates that drab and monotonous environments are linked to depression and confusion; on the other hand personalized environments that are rich in details are associated with positive emotions, the expression of personal identities and a sense of meaning (Ashkanasy et al., 2014; Brunia & Hartjes-Gosselink, 2009; Wells, 2000). A more personalized space on a group level may mitigate the lack of ownership, although it is important to note that such personalization should be based on employees' suggestions.

The employees found the office environment less comprehensible due to the lack of behavioural rules, an ambiguous facility management strategies/processes leading to feelings of frustration toward colleagues, and a maintenance system experienced as inconsistent with the follow-ups. The importance of clear behavioural rules for successful implementations (Appel-Meulenbroek et al., 2011; Rolfö et al., 2018) as well as employee involvement in the change process (e.g. Hongisto et al., 2016; Lahtinen et al., 2015; Rolfö, 2018; Vischer, 2008) have been emphasized by previous research. Furthermore, the frustration caused by the maintenance system is consistent with other studies showing that a sense of resignation occurs when management does not address issues that disrupt employees' work (Babapour Chafi, 2019) and the role of management has been found to be crucial in creating a sense of comprehensibility, manageability and meaningfulness (Lahtinen et al., 2015). Hence, better comprehensibility may be achieved through constant open discussions between management and employees concerning the reasons, goals and implications of change.

Methodological concerns and future research

The contextual nature of architectural design and health motivated choosing a qualitative case-study approach. Case studies are considered useful research approaches as they enable researchers to examine individuals or groups within their specific context (Yin, 2012). Given that flexible offices vary in design, as well as in the way they are implemented, our results cannot be generalized to other cases, nor are they intended to. Instead, our findings are transferable (cf. criteria for ensuring the quality of qualitative studies by Miles & Huberman, 1994) in that perceptions of office environment evolve over time and the sense of coherence components can be experienced differently by different employees within

an organization, and this will likely occur in other cases. The qualitative approach was found a valuable approach to study employees' experience in relation to their perceived health over time, at the same office (cf. Creswell, 2014). A key strength in applying the sense of coherence framework was its holistic perspective. This allowed the investigation of a range of aspects, from those causing illness to coping strategies, adaptations, and positive effects. Our findings can inform future research for developing survey instruments to assess sense of coherence in the office environment. This will allow for comparisons between different cases for achieving generalizable insights.

Several strategies contribute to the dependability/reliability of this qualitative case study: transparent and thorough description of the case context; triangulation and comprehensive use of multiple data sources. The measures taken to replicate the study design in Wave 2 and ensure credibility were: the discussions between the researchers to ensure a consistent analysis strategy; and dialogue with the interviewees for confirming the results.

The main advantage of this study is its longitudinal perspective on employees' experience of relocating from cell offices to a combi office and its positive approach to health (not only focusing on the negative influences) using sense of coherence as a theoretical framework. Using the same mixed-method case study approach in both waves, six months and two years post-relocation, enabled the comparison of employee perceptions and gain a deep understanding of the influences of the physical environment on employees' sense of coherence. These time points are in line with other longitudinal studies of office environments in which one of the data collection procedures is often conducted within the first year post-relocation (Bergström et al., 2015; Haapakangas et al., 2019; Meijer et al., 2009). Therefore, studies investigating what makes an office design healthy or the interrelations between office environments and employees' health, may benefit from adopting longitudinal approaches like the one presented in this paper.

Practical implications

Several implications for practice are apparent. To improve manageability, practitioners should pay close attention to enabling control over stimuli through, for example, curtains and screens that allow employees to craft preferred levels of visual and acoustic privacy. Automated shades can lead to compromised user experience and therefore should be reconsidered, especially in countries such as Sweden wherein daylight

is scarce during the cold months. In flexible offices, the abundance of space can spread people around which eventually may lead to isolation in the long term and thereby, reduce meaningfulness. Practitioners should consider opportunities for personalization of social areas to support collective identity expression, a sense of community and group cohesion. Furthermore, to facilitate better comprehensibility and meaningfulness, management should engage in recurring communication and dialogue with employees. Hence, management's role is crucial not only in the relocation but also in the operation phase to support health development within the office.

Antonovsky (1996) used the 'Health in the River of Life' analogy to indicate that it is not enough to build bridges to keep people from falling into the river (Eriksson & Lindström, 2008). Instead, people must learn to swim. That is combining the conventional pathogenic perspective that focuses on the question 'who or what pushed us into the river?' (identifying the risk factors, e.g. noise), with a salutogenic approach. This helps to identify the characteristics that allow 'swimming in a river' and the factors that help one develop and improve swimming ability. In the office context, these factors may include, for example, opportunities to craft an environment that matches one's needs and preferences (e.g. from the provision of noise-cancelling headphones to noise absorbing artefacts and quiet rooms). Therefore, instead of aiming for an idealistic environment and a state of 'complete' well-being (World Health Organization, 1948), office design should aim at a design that empowers individuals to adapt and self-manage actively and positively (Huber et al., 2011).

Concluding remarks

This study showed that most of the positive perceptions of the office environment deteriorated over time. The employees found the office less meaningful in Wave 2, due to the reduced opportunities for social interactions and personalization. The office was also experienced less comprehensible due to the lack of behavioural rules, ambiguous facility management strategies/processes, and a maintenance system that was perceived as unresponsive to fault reports. The perceptions of the office manageability remained stable in both waves, as the lacking sense of control over the environment was compensated by a high level of autonomy. Contextual aspects, such as tasks, flexible working culture and the change processes, were identified that further elucidate how the changes in perceptions evolved over time.

This study has demonstrated that negative influences caused by poor design choices do not resolve themselves

over time, without support from the facility management. When there is limited support for one component of sense of coherence, the initial observed benefits wear off and negative influences may spill over into other components. Therefore, office design should be approached with balanced attention to comprehensibility, manageability, and meaningfulness. Any move towards healthy office design should include mitigation of deficiencies and promotion of salutogenic resources to create and maintain health.

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References

- Antonovsky, A. (1979). *Health, stress, and coping: New perspective on mental and physical well-being*. Jossey-Bass.
- Antonovsky, A. (1987). *Unraveling the mystery of health*. Jossey-Bass.
- Antonovsky, A. (1993). The structure and properties of sense of coherence scale. *Social Science & Medicine*, 36(6), 725–733. [https://doi.org/10.1016/0277-9536\(93\)90033-Z](https://doi.org/10.1016/0277-9536(93)90033-Z)
- Antonovsky, A. (1996). The salutogenic model as a theory to guide health. *Health Promotion International*, 11(1), 11–18. <https://doi.org/10.1093/heapro/11.1.11>
- Appel-Meulenbroek, R., Clippard, M., & Pfnur, A. (2018). The effectiveness of physical office environments for employee outcomes: An interdisciplinary perspective of research efforts. *Journal of Corporate Real Estate*, 20(1), 56–80. <https://doi.org/10.1108/JCRE-04-2017-0012>
- Appel-Meulenbroek, R., Groenen, P., & Janssen, I. (2011). An end-users perspective on activity-based office concepts.

- Journal of Corporate Real Estate*, 13(2), 122–135. <https://doi.org/10.1108/14630011111136830>
- Ashkanasy, N. M., Ayoko, O. B., & Jehn, K. A. (2014). Understanding the physical environment of work and employee behavior: An affective events perspective. *Journal of Organizational Behavior*, 35(8), 1169–1184. <https://doi.org/10.1002/job.1973>
- Babapour Chafi, M. (2019). From fading novelty effects to emergent appreciation of activity-based flexible offices: Comparing the individual, organisational and spatial adaptations in two case organisations. *Applied Ergonomics*, 81 (October 2018). <https://doi.org/10.1016/j.apergo.2019.102877>
- Bauer, G. F., & Jenny, G. J. (2016). The application of salutogenesis to organisations. In M. Mittelmark, S. Sagy, M. Eriksson, G. Bauer, J. Pelikan, B. Lindström, & G. Espnes (Eds.), *The handbook of salutogenesis* (pp. 211–224). Springer.
- Bergström, J., Miller, M., & Horneij, E. (2015). Work environment perceptions following relocation to open-plan offices: A twelve-month longitudinal study. *Work*, 50(2), 221–228. <https://doi.org/10.3233/WOR-131798>
- Berlin, C., & Babapour Chafi, M. (2020). *Physical work environment for health, well-being and performance – A systematic review*. Swedish Agency for Work Environment Expertise. www.sawee.se
- Bernstein, E. S., & Turban, S. (2018). The impact of the ‘open’ workspace on human collaboration. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 373(1753), <https://doi.org/10.1098/rstb.2017.0239>
- Blok, M., De Korte, E. M., Groenesteijn, L., Formanoy, M., & Vink, P. (2009). The effect of a task facilitating working environment on office space use, communication, concentration, collaboration, privacy and distraction. In *Proceedings of the 17th World Congress on Ergonomics (IEA 2009)* (pp. 9–14). International Ergonomics Association. <https://research.tudelft.nl/en/publications/the-effects-of-a-task-facilitating-working-environment-on-office->
- Bodin Danielsson, C., & Bodin, L. (2008). Office type in relation to health, well-being, and job satisfaction among employees. *Environment and Behavior*, 40(5), 636–668. <https://doi.org/10.1177/0013916507307459>
- Braun-Lewensohn, O., Idan, O., Lindström, B., & Margalit, M. (2016). Salutogenesis: Sense of coherence in adolescence. In *The handbook of salutogenesis* (pp. 123–136). <https://doi.org/10.1007/978-3-319-04600-6>
- Brennan, A., Chugh, J. S., & Kline, T. (2002). Traditional versus open office design: A longitudinal field study. *Environment and Behavior*, 34(3), 279–299. <https://doi.org/10.1177/0013916502034003001>
- Brunia, S., & Hartjes-Gosselink, A. (2009). Personalization in non-territorial offices: A study of a human need. *Journal of Corporate Real Estate*, 11(3), 169–182. <https://doi.org/10.1108/14630010910985922>
- Candido, C., Thomas, L., Haddad, S., Zhang, F., Mackey, M., & Ye, W. (2019). Designing activity-based workspaces: Satisfaction, productivity and physical activity. *Building Research and Information*, 47(3), 275–289. <https://doi.org/10.1080/09613218.2018.1476372>
- Clements-Croome, D. (2018). Effects of the built environment on health and well-being. In D. Clements-Croome (Ed.), *Creating productive workplace* (3rd ed., pp. 3–40). Routledge.
- Cobaleda-Cordero, A., Babapour, M., & Karlsson, M. A. (2019). Feel well and do well at work: A post-relocation study on the relationships between employee wellbeing and office landscape. *Journal of Corporate Real Estate*, 22 (2), 113–137. <https://doi.org/10.1108/JCRE-01-2019-0002>
- Colenberg, S., Jylhä, T., & Arkesteijn, M. (2020). The relationship between interior office space and employee health and well-being: A literature review. *Building Research and Information*, 1–15. <https://doi.org/10.1080/09613218.2019.1710098>
- Creswell, J. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed.). Sage.
- Danko, S., Eshelman, P., & Hedge, A. (1990). A taxonomy of health, safety, and welfare implications of interior design decisions. *Journal of Interior Design Education and Research*, 16(2), 19–30. <https://doi.org/10.1111/j.1939-1668.1990.tb00051.x>
- Davis, M. C., Leach, D. J., & Clegg, C. W. (2011). The physical environment of the office: Contemporary and emerging issues. In G. P. Hodgkinson & J. K. Ford (Eds.), *International review of industrial and organizational psychology, 2012* (pp. 193–235). Wiley. <https://doi.org/10.1002/9781118311141.ch6>
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*, 49(3), 182–185. <https://doi.org/10.1037/a0012801>
- Engelen, L., Chau, J., Young, S., Mackey, M., Jeyapalan, D., & Bauman, A. (2019). Is activity-based working impacting health, work performance and perceptions? A systematic review. *Building Research and Information*, 47(4), 468–479. <https://doi.org/10.1080/09613218.2018.1440958>
- Eriksson, M., & Lindström, B. (2006). Antonovsky’s sense of coherence scale and the relation with health: A systematic review. *Journal of Epidemiology & Community Health*, 60 (5), 376–381. <https://doi.org/10.1136/jech.2005.041616>
- Eriksson, M., & Lindström, B. (2007). Antonovsky’s sense of coherence scale and its relation with quality of life: A systematic review. *Journal of Epidemiology and Community Health*, 61(11), 938–944. <https://doi.org/10.1136/jech.2006.056028>
- Eriksson, M., & Lindström, B. (2008). A salutogenic interpretation of the Ottawa Charter. *Health Promotion International*, 23(2), 190–199. <https://doi.org/10.1093/heapro/dan014>
- Gagné, M., Senécal, C. B., & Koestner, R. (1997). Proximal job characteristics, feelings of empowerment, and intrinsic motivation: A multidimensional model. *Journal of Applied Social Psychology*, 27(14), 1222–1240. <https://doi.org/10.1111/j.1559-1816.1997.tb01803.x>
- Gerdenitsch, C., Korunka, C., & Hertel, G. (2018). Need-supply fit in an activity-based flexible office: A longitudinal study during relocation. *Environment and Behavior*, 50(3), 273–297. <https://doi.org/10.1177/0013916517697766>
- Golembiewski, J. A. (2010). Start making sense: Applying a salutogenic model to architectural design for psychiatric care. *Facilities*, 28(3/4), 100–117. <https://doi.org/10.1108/02632771011023096>
- Golembiewski, J. A. (2016). Salutogenic architecture in health-care settings. In *The handbook of salutogenesis* (pp. 267–276). <https://doi.org/10.1007/978-3-319-04600-6>

- Groen, B. H., Jylhä, T., & van Sprang, H. (2018, September 19–21). *Healthy offices: An evidence-based trend in facility management?* Transdisciplinary Workspace Research Conference Tampere 2018.
- Haapakangas, A., Hallman, D. M., Mathiassen, S. E., & Jahncke, H. (2019). The effects of moving into an activity-based office on communication, social relations and work demands – A controlled intervention with repeated follow-up. *Journal of Environmental Psychology*, 66(August), 101341. <https://doi.org/10.1016/j.jenvp.2019.101341>
- Heerwagen, J. H., Heubach, J. G., Montgomery, J., & Weimer, W. C. (1995). Environmental design, work, and well being. *AAOHN Journal*, 43(9), 458–468. <https://doi.org/10.1177/216507999504300904>
- Hongisto, V., Haapakangas, A., Varjo, J., Helenius, R., & Koskela, H. (2016). Refurbishment of an open-plan office – Environmental and job satisfaction. *Journal of Environmental Psychology*, 45, 176–191. <https://doi.org/10.1016/j.jenvp.2015.12.004>
- Huber, M., André Knottnerus, J., Green, L., Van Der Horst, H., Jadad, A. R., Kromhout, D., Leonard, B., Lorig, K., Loureiro, M. I., Van Der Meer, J. W. M., Schnabel, P., Smith, R., Van Weel, C., & Smid, H. (2011). How should we define health? *BMJ (Online)*, 343(7817). <https://doi.org/10.1136/bmj.d4163>
- Idan, O., Braun-Lewensohn, O., Lindström, B., & Margalit, M. (2017). Salutogenesis: Sense of coherence in childhood and in families. In M. B. Mittelmarm, S. Sagy, M. Eriksson, G. F. Bauer, J. M. Pelikan, B. Lindström, & G. A. Espnes (Eds.), *The handbook of salutogenesis*. Springer. <https://doi.org/10.1007/978-3-319-04600-6>
- Idan, O., Eriksson, M., & Al-Yagon, M. (2016). The salutogenic model: The role of generalized resistance resources. In M. Mittelmarm, S. Sagy, M. Eriksson, G. Bauer, J. Pelikan, B. Lindström, & G. Espnes (Eds.), *The handbook of salutogenesis* (pp. 57–69). Springer.
- Ilardi, B. C., Leone, D., Kasser, T., & Ryan, R. M. (1993). Employee and supervisor ratings of motivation: Main effects and discrepancies associated with Job satisfaction and adjustment in a factory setting. *Journal of Applied Social Psychology*, 23(21), 1789–1805. <https://doi.org/10.1111/j.1559-1816.1993.tb01066.x>
- Inalhan, G., & Finch, E. (2004). Place attachment and sense of belonging. *Facilities*, 22(5), 120–128. <https://doi.org/10.1108/02632770410540333>
- Jambroes, M., Nederland, T., Kaljouw, M., Van Vliet, K., Essink-Bot, M. L., & Ruwaard, D. (2016). Implications of health as “the ability to adapt and self-manage” for public health policy: A qualitative study. *European Journal of Public Health*, 26(3), 412–416. <https://doi.org/10.1093/eurpub/ckv206>
- Jensen, P. A., & van der Voordt, T. (2019). Healthy workplaces: What we know and what else we need to know. *Journal of Corporate Real Estate*, 22(2), <https://doi.org/10.1108/jcre-11-2018-0045>
- Kämpf-Dern, A., & Konkol, J. (2017). Performance-oriented office environments – Framework for effective workspace design and the accompanying change processes. *Journal of Corporate Real Estate*, 19(4), 208–238. <https://doi.org/10.1108/JCRE-03-2017-0009>
- Koelen, M., Eriksson, M., & Cattan, M. (2016). Older people, sense of coherence and community. In *The handbook of salutogenesis* (pp. 137–149). Springer. <https://doi.org/10.1007/978-3-319-04600-6>
- Kupritz, V. W. (1998). Environmental psychology privacy in the work place: The impact of building design. *Journal of Environmental Psychology*, 18(4), 341–356. <https://doi.org/10.1006/jevp.1998.0081>
- Lahtinen, M., Ruohomäki, V., Haapakangas, A., & Reijula, K. (2015). Developmental needs of workplace design practices. *Intelligent Buildings International*, 7(4), 198–214. <https://doi.org/10.1080/17508975.2014.1001315>
- Lamb, S., & Kwok, K. C. S. (2016). A longitudinal investigation of work environment stressors on the performance and wellbeing of office workers. *Applied Ergonomics*, 52(2016), 104–111. <https://doi.org/10.1016/j.apergo.2015.07.010>
- Meijer, E. M., Frings-Dresen, M. H. W., & Sluiter, J. K. (2009). Effects of office innovation on office workers’ health and performance. *Ergonomics*, 52(9), 1027–1038. <https://doi.org/10.1080/00140130902842752>
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.
- Oseland, N. (2009). The impact of psychological needs on office design. *Journal of Corporate Real Estate*, 11(4), 244–254. <https://doi.org/10.1108/14630010911006738>
- Rolfö, L. (2018). Relocation to an activity-based flexible office – Design processes and outcomes. *Applied Ergonomics*, 73 (May), 141–150. <https://doi.org/10.1016/j.apergo.2018.05.017>
- Rolfö, L., Eklund, J., & Jahncke, H. (2018). Perceptions of performance and satisfaction after relocation to an activity-based office. *Ergonomics*, 61(5), 644–657. <https://doi.org/10.1080/00140139.2017.1398844>
- Roskams, M., & Haynes, B. (2019). Salutogenic workplace design: A conceptual framework for supporting sense of coherence through environmental resources. *Journal of Corporate Real Estate*, 22(2), 139–153. <https://doi.org/10.1108/JCRE-01-2019-0001>
- Ruohomäki, V., Lahtinen, M., & Reijula, K. (2015). Salutogenic and user-centred approach for workplace design. *Intelligent Buildings International*, 7(4), 184–197. <https://doi.org/10.1080/17508975.2015.1007911>
- Sander, E., Libby, J., Caza, A., & Jordan, P. J. (2019). Psychological perceptions matter: Developing the reactions to the physical work environment scale. *Building and Environment*, 148(November 2018), 338–347. <https://doi.org/10.1016/j.buildenv.2018.11.020>
- Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological Theory*, 30(3), 167–186. <https://doi.org/10.1177/0735275112457914>
- Van Der Voordt, T. J. M., Vrieling, D., & Van Wegen, H. B. R. (1997). Comparative floorplan-analysis in programming and architectural design. *Design Studies*, 18(1), 67–88. [https://doi.org/10.1016/s0142-694x\(96\)00016-6](https://doi.org/10.1016/s0142-694x(96)00016-6)
- Vischer, J. C. (2008). Towards an environmental psychology of workspace: How people are affected by environments for work. *Architectural Science Review*, 51(2), 97–108. <https://doi.org/10.3763/asre.2008.5114>
- Vogt, K., Hakanen, J. J., Jenny, G. J., & Bauer, G. F. (2016). Sense of coherence and the motivational process of the job-demands-resources model. *Journal of Occupational Health Psychology*, 21(2), 194–207. <https://doi.org/10.1037/a0039899>
- Wells, M. M. (2000). Office clutter or meaningful personal displays: The role of office personalization in employee and

- organizational well-being. *Journal of Environmental Psychology*, 20(3), 239–255. <https://doi.org/10.1006/jevp.1999.0166>
- Wijk, K., Bergsten, E. L., & Hallman, D. M. (2020). Sense of coherence, health, well-being, and work satisfaction before and after implementing activity-based workplaces. *International Journal of Environmental Research and Public Health*, 17(14), 1–15. <https://doi.org/10.3390/ijerph17145250>
- Wilson, E. O. (1984). *Biophilia*. Harvard University Press.
- Wohlers, C., & Hertel, G. (2018). Longitudinal effects of activity-based flexible office design on teamwork. *Frontiers in Psychology*, 9(OCT), 1–16. <https://doi.org/10.3389/fpsyg.2018.02016>
- World Health Organization. (1948). *Constitution of the World Health Organization*.
- Yin, R. K. (2012). Applications of case study research. In *Applications of case study research* (pp. 3–20). Sage.